Radio, Electronics and Communications

FORMERLY "RADIO & ELECTRICAL REVIEW" — WIDELY KNOWN SINCE 1946 AS "R. & E."

MPL

In This Issue . . .

- F.M./V.H.F. for Auckland Harbour Board.
- Radio-Telephones.
- Marine Radar.
- A Thermistor Thermometer
- "White Line" Fish Finding.
- A Transistor DC Converter.
- Hi-Fi Amplifier — Final Section.

OCTOBER 1, 1965

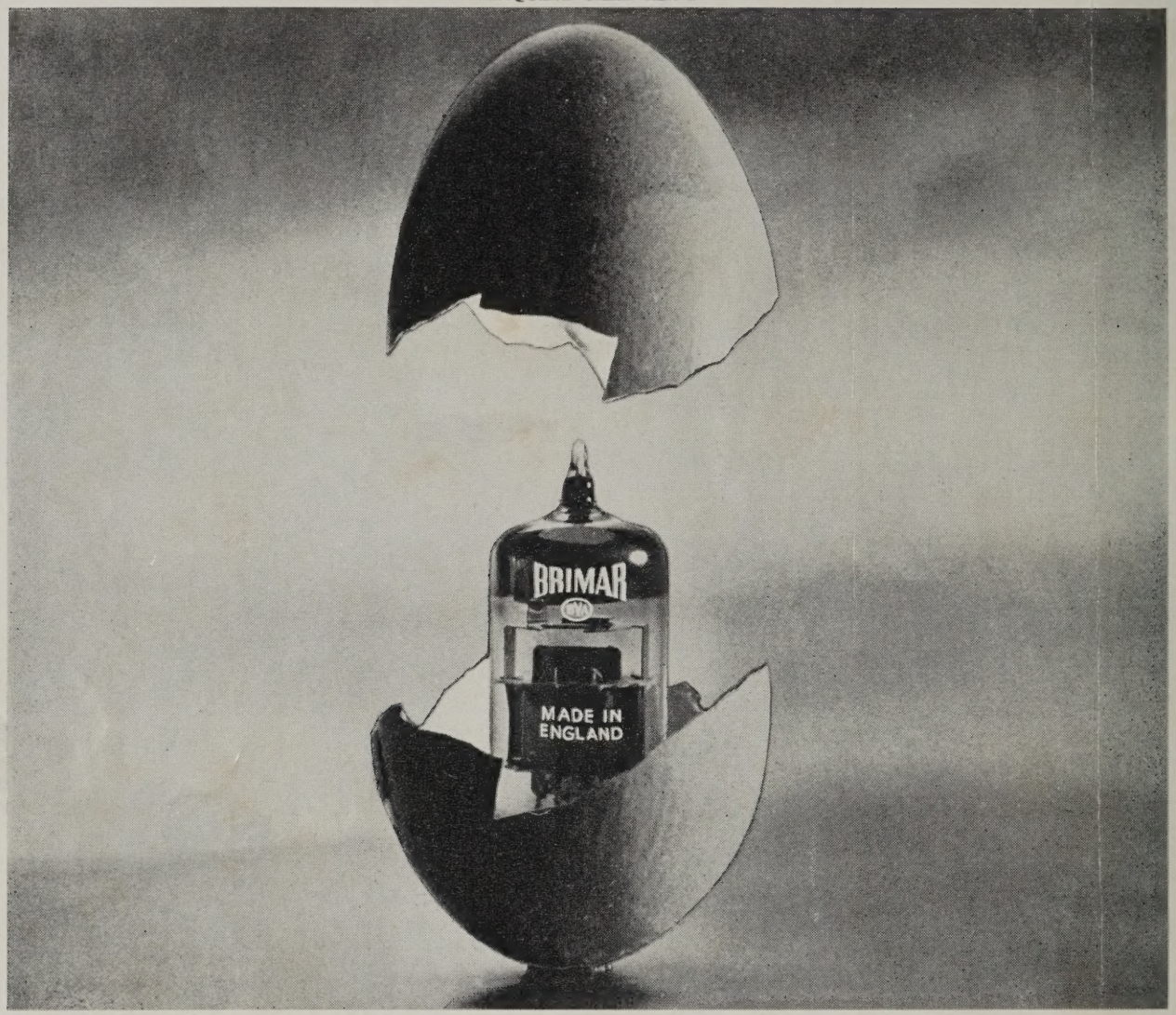
PUBLISHED MONTHLY IN THE INTERESTS OF THE N.Z. ELECTRONICS INDUSTRY FOR ALL LEVELS, FROM PROFESSIONAL TO AMATEUR.

VOLUME 40 NUMBER 8

PRICE 2/6

SPECIAL MARINE ISSUE

ENQUIRY CARD AD. 1



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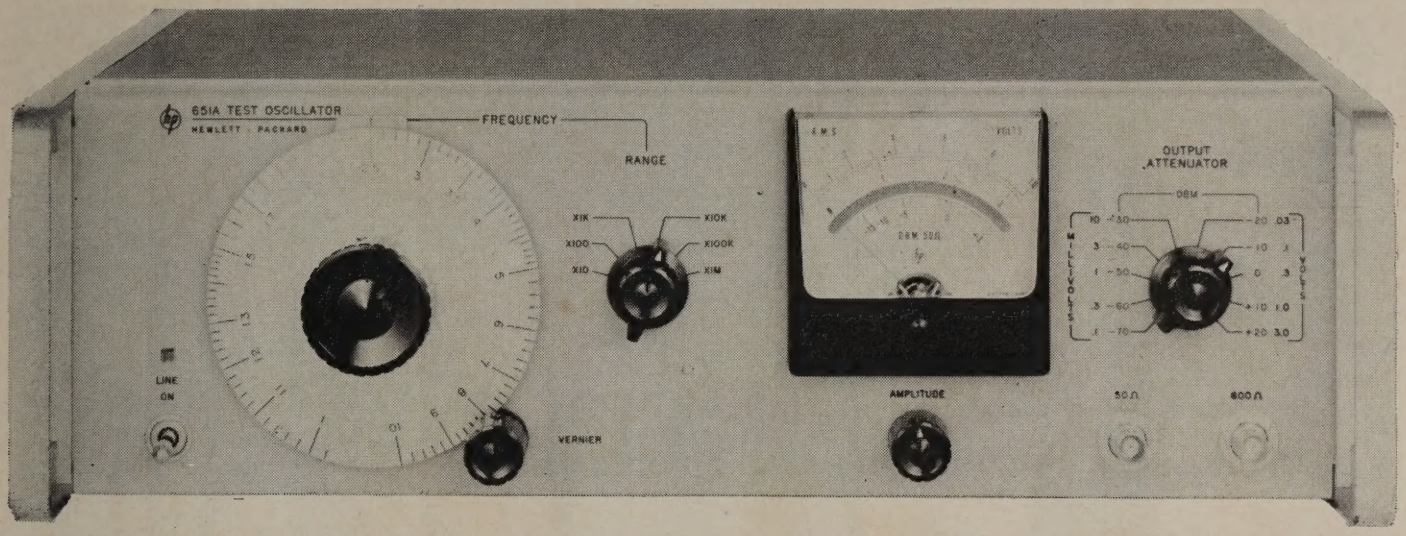

New improved solid-state model of Hewlett-Packard's historic state-of-the-art 10 hz - 10 mhz test oscillator! Offers unduplicated advances for unmatched utility: True 50-ohm and 600-ohm output system for simple matching. Plus these specified improvements in frequency resolution, noise characteristics, stability, accuracy, distortion specs, frequency response:

IMPROVED PERFORMANCE, 651A TEST OSCILLATOR

Frequency range: 10 hz to 10 mhz, 6 bands, dial calibration 1 to 10
Frequency response: Flat within ±2% across range from 100 hz to 4mhz; ±3%, 10 to 100 hz; ±4%, 4 mhz to 10 mhz
Dial accuracy: ±2%, 100 hz to 1 mhz, including warm-up drift and ±10% line variation; ±3%, 10 to 100 hz and 1 to 10 mhz
Frequency stability: Typically 10 ppm (short term)
Distortion: Less than 1%, 10 hz to 5 mhz approx. 2% at 10 mhz
Output: 3.16 v into 50 ohms or 600 ohms; 6.32 v open circuit
Hum and noise: Less than 0.05% of output
Monitor accuracy: ±2% of full scale
Monitor flatness: ±1% at full scale, 20 hz to 5 mhz
Attenuator: 90 db in 10 db steps, ±1%; with 20 db vernier between steps; Zo=50 ohms and 600 ohms
Dimensions: 5-7/32" high x 16¾" wide x 13¼" deep; 17 lbs.

This new test oscillator out-performs all its "copies," past and present . . . and even improves on the performance of the famous standard, the .hp 650A! As a solid-state Wein bridge oscillator using capacitive tuning, it is ideal for wide band response testing, voltmeter calibration, testing of audio-video systems and low level measurements. Further versatility is offered with two outputs, 3.16 v into 50 ohms or 600 ohms. Matching to loads greater than 50 ohms can be accomplished by adding a series resistor. The unmatched performance of the 651A is indicated by the specifications. Ask for demonstration and check its performance. Price £N.Z.309/15/-. $N.Z.618.50. Duty paid delivered anywhere in New Zealand.

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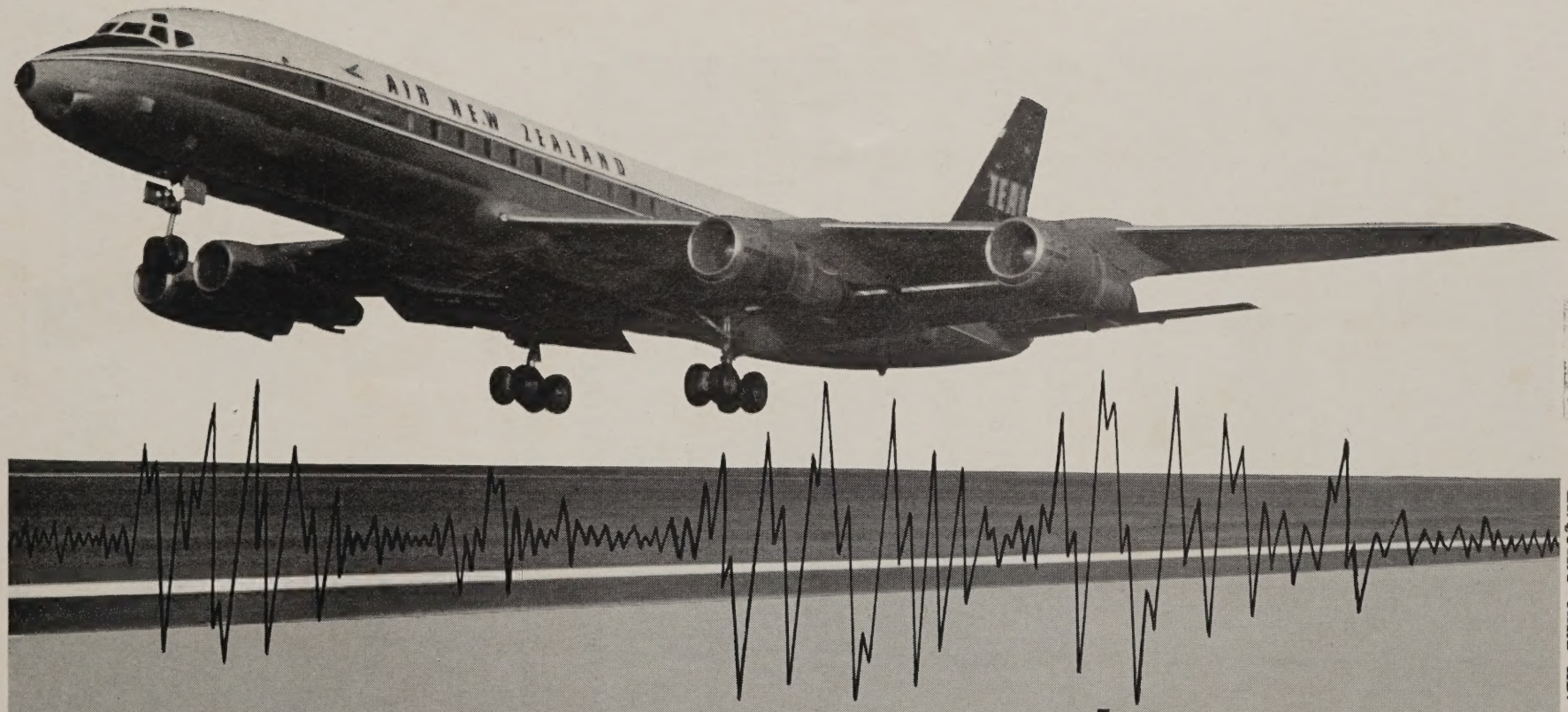

when the decibels rise

Sound level, vibration level and strain are measured throughout the world, analysed and recorded by Brüel & Kjær instruments and systems. Brüel & Kjær equipment is at present being used in New Zealand for essential research and development work by the N.Z.B.C., the D.S.I.R., Air New Zealand, the Universities and many industrial organisations. In the highly mechanised world of today, sound measuring equipment plays an all-important part, not only to measure, but to analyse and record noise level and vibration in factories, in the cities and at airports. For full details of Brüel & Kjær equipment available in New Zealand, write or call

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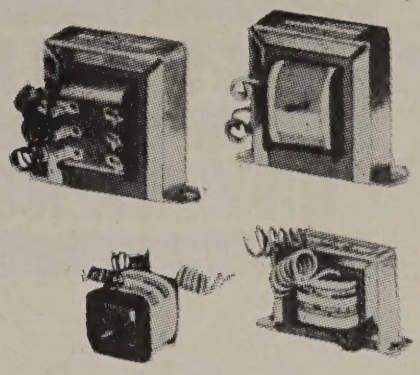
EN.5FP

ENQUIRY CARD AD. 4

OUTPUT TRANSFORMERS to your requirements

by ATC



We Manufacture many types of Output Transformers for New Equipment and Replacement Repair Work.
WINDINGS AVAILABLE FOR OP1-14 and OP18-22 INCLUSIVE

Type No.	Wattage	Impedance Ratio	Bobbin Size	Colour Code	Mounting
†OP1	3	5K/3 ohms	9/16 Square	Red	Clamp
†OP2	3	7K/3 „	9/16 „	Yellow	„
†OP3	3	10K/3 „	9/16 „	White	„
†OP3 C	3	10KCT/3 ohms	9/16 „	White	„
†OP4	6	5K/3 „	¾ Square	Red	„
†OP5	6	7K/3 „	¾ „	Yellow	„
†OP6	6	10KCT/3 „	¾ „	White	„
†OP7	6	14KCT/3 „	¾ „	Black	„
†OP8	4.5	5K/3 „	11/16 x 13/16	Red	„
†OP9	4.5	7K/3 „	11/16 x 13/16	Yellow	„
†OP10	4.5	10KCT/3 „	11/16 x 13/16	White	„
†OP11	4.5	14KCT/3 „	11/16 x 13/16	Black	„
†OP12	4.5	Universal	11/16 x 13/16	—	„
†OP13	6	Universal	¾ x ¾	—	„
†OP14	10W	Universal	¾ x ¾	—	„
OP15	20	5KCT/Univ.	1" x 1¼	—	Side covers & feet
OP16	20	6.6KCT/ „	1" x 1¼	—	„
OP17	20	10KCT/ „	1" x 1¼	—	„
OP21	2W	5K/3	½"	Red	Windings Only
OP22	2W	7K/3	½"	Yellow	„ „
OP23	35W	5KCT/Univ.	2" x 1¼	—	Covers & Feet
OP24	35	6.6KCT/ „	2" x 1¼	—	„ „
OP25	35	10KCT/ „	2" x 1¼	—	„ „
OP26	15W	Hifi 5KCT/15 ohms	2" x 1¼	—	„ „
OP27	15W	Hifi 8KCT/15 „	2" x 1¼	—	„ „
OP28	15W	Hifi 10KCT/15 „	2" x 1¼	—	„ „
		ULTRA LINEAR TYPE			
OP29	20W	6.6KCT/15 ohms	2" x 1¼	—	„ „
OP30	20	8.5KCT/15 „	2" x 1¼	—	„ „
OP31	20	10KCT/15 „	2" x 1¼	—	„ „
		LOW POWER EXTENDED RANGE			
OP32	6W	8KCT/7 ohms	1¼" x ⅞"	—	Clamp
OP33	6W	8KCT/15 „	1¼" x ⅞"	—	Clamp
OP34	3W	Universal	9/16 x 9/16	—	„
OP35	6W	10KCT/15-7.5-3 ohms	¾ x ¾	—	„
OP36					
OP37 / OP50	8W U/L / 10W stereo	9KCT/15-7.5-3 ohms	⅞" x ⅞"	—	„

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MULTIMETER CONVENIENCE with LABORATORY PRECISION!

Look what you can measure with the hp 410C Electronic Voltmeter:

1. **dc voltage, 1.5 mv to 1500 v; no zero set**
2. **dc current, 0.15 nanoamps to 150 ma; no zero set**
3. **ac voltage, 50 mv to 300 v; to 700 mhz**
4. **resistance, 0.2 ohm to 500 megohms; no zero or ∞ set**

Never in electronic measurement has so small an instrument done so much so well! Ideal for use in the lab or service department or on the production line. A unique hybrid circuit eliminates drift (and the need for a zero set) and provides such features as 100 megohms dc voltmeter input impedance; low resistance recorder output, 1.5 v dc at full scale; dc voltage accuracy of ± 2% of full scale, current accuracy of ± 3% of full scale, floating input for measurement to 400 v above chassis ground. The 410C also incorporates a rugged individually calibrated taut band meter movement. Get all the facts from the specifications below. Then ask us for a demonstration of this Hewlett-Packard instrument. **Data subject to change without notice. Duty paid price £NZ223/2/6. $NZ446.25, delivered anywhere in New Zealand.**

GENERAL

Maximum Input: dc-100 v on 15, 50 and 150 mv ranges; 500 v on 0.5 to 15 v ranges: 1600 v on higher ranges; ac-100 times full scale or 450 v peak, whichever is less.
Power: 115 or 230 volts ± 10%, 50 to 100 hz, 13 watts (20 watts with hp 1103A probe)
Dimensions: 6-17/32" high, 51/8" wide, 11" deep behind panel

DC VOLTMETER

Range: ± 15 mv to ± 1500 v full scale
Accuracy: ± 2% of full scale, any range
Input resistance: 100 megohms ± 1% on 500 mv range and above; 10 megohms ± 1% on 15 mv, 50 mv and 150 mv ranges

DC AMMETER

Ranges: ± 1.5 μa to ± 150 ma full scale
Accuracy: ± 3% of full scale, any range
Input resistance: decreasing from 9 k ohms on 1.5μa scale to approx. 0.3 ohm on 150 ma scale
Special current ranges: ± 1.5, ± 5, and ± 15 nanoamps to ± 5% on the 15, 50 and 150 mv ranges using voltmeter probe

OHMMETER

Range: 10 ohms to 10 megohms, centre scale
Accuracy: ± 5% of reading of mid-scale

AMPLIFIER

Voltage gain: 100 maximum
Output: proportional to meter indication; 15 v dc at full scale; maximum current 1 ma; impedance less than 3 ohms at dc
AC rejection: 3 db at ½ hz; approx. 66db at 50 hz and higher frequencies for signals less than 1600 v peak or 30 times full scale, whichever is smaller
Noise: less than 0.5% of full scale on any range (p-p)
DC drift: less than 0.5% of full scale/year at constant temperature; less than 0.02% of full scale/°C
Recovery: recovers from 100:1 overload in less than 3 sec
Ranges: 0.5 v to 300 v full scale, 7 ranges
Accuracy: ± 3% of full scale at 400 hz for sinusoidal voltages from 0.5 to 300 v rms; ac probe responds to the positive peak-above-average value of applied signal.
Frequency response: —3% ± 2% at 100 mhz; ± 10% from 20 hz to 700 mhz (400 hz reference); indications to 3 ghz
Frequency range: 20 hz to 700 mhz
Input resistance: input capacity 1.5 pf, input resistance greater than 10 megohms at low frequencies; at high frequencies impedance drops because of dielectric loss
Meter: calibrated in rms volts for sine wave input

Radio, Electronics and Communications

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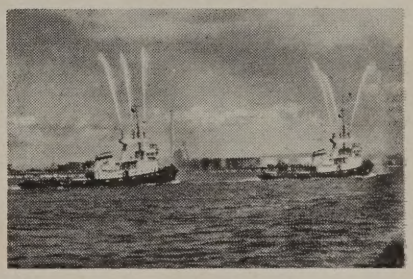
On Our Cover



Recently, orders exceeding £20,000 for Marine Radar equipment were placed with Amalgamated Wireless (Australasia) N.Z. Limited. Vessels to be fitted include trans-Tasman and coastal ships, pilot vessels, tugs and fishing boats.

Picture shows two Whangarei Harbour Board tugs which were equipped by AWA with Radar, Echo-sounders and Communication apparatus.

COMING . . .

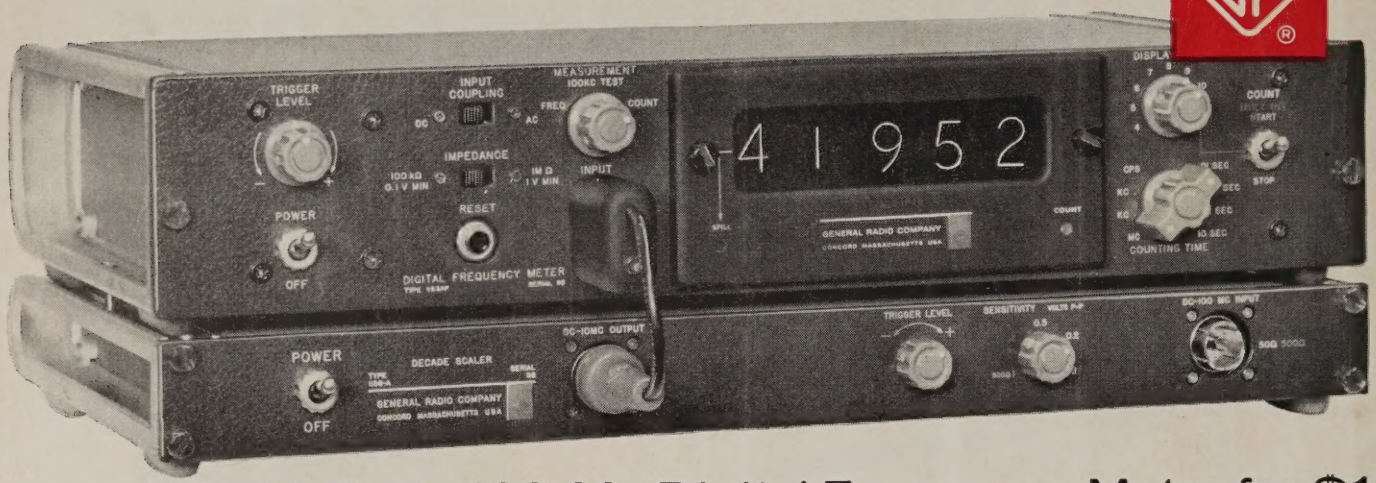
The Development of Research on Very Low Frequency Propagation
CCIR Interim Study Group Meetings
A Medium and High Frequency Band Aerial with vertical directivity
Mobile Communications — Part VI
British Post Office Tower

ALSO . . .

Hi-Fi Amplifier—concluding section
Listening Post
Circuit & Service Data
Camera View
Serviceman's Column
New Products

ENQUIRY CARD AD. 7

new



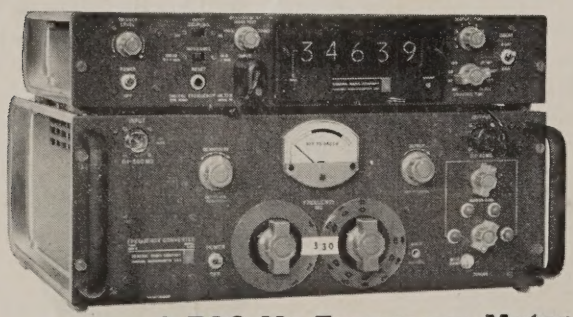
A Solid-State 100-Mc Digital Frequency Meter for $1995

...with direct counting over the entire dc to 100-Mc Range

This is a complete digital frequency meter with features you'd expect to find only in much more expensive units. Adjustable input sensitivity and trigger-level control ensure maximum measurement accuracy with any waveform, from sine wave to random pulse train. In-line readout is bright and sharp — decimal point, units, and spill indication (when count exceeds register capacity) are presented automatically. The counter is easy to use; direct-counting methods, rather than heterodyning, make frequency measurement an automatic operation over the entire range. A second model, the Type 1144-AP, is available with data output for printer or D/A converter.

The Type 1144-A Digital Frequency Meter is a combination of two new instruments: a decade scaler and a 10-Mc counter. The Type 1156-A Decade Scaler divides the unknown frequency, providing an output signal whose frequency is exactly one-tenth the unknown frequency. The Type 1153-A Digital Frequency Meter measures the frequency of this signal and displays the value on a five-digit bank of indicators. Choice of four gate times allows eight-figure resolution at the low cost of a five-digit counter.

Since both the counter and the Decade Scaler are self-sufficient instruments, they can be used to advantage in other measurements — the scaler as a precision 10:1 frequency divider, the counter as a complete 10-Mc digital frequency meter.



A 500-Mc Frequency Meter with High Sensitivity and Selectivity

Sensitivity is better than 10 mV from 100 kc/s to 500 Mc/s, better than 100 mV from dc to 100 kc/s... choice of narrow-band or wide-band operation.

Type 1143-A Frequency Measuring Assembly, $3090, includes:
Type 1153-A 10-Mc Digital Frequency Meter,
Type 1133-A 500-Mc Frequency Converter,
time-base frequency multiplier, and all interconnecting cables.

INPUT: dc to 100 Mc/s
Sensitivity: (switch selected) 0.1, 0.2, 0.5, and 1.0 Volt, peak-to-peak at 50Ω, 1.0 Volt at 500Ω.
Maximum Input: 20 times sensitivity, or ½ watt, whichever is smaller.
Impedance: 50Ω or 500Ω (switch selected).
VSWR: 1.1 max at 100 Mc/s (50Ω).
Reflection: 10% max with 0.4ns step (50Ω).
ACCURACY: For 1153-A Digital Frequency Meter, ±1 count ±time-base accuracy.

TIME BASE:
Frequency: 100 kc/s from room temperature crystal oscillator — no warmup required.
Temperature Effects: less than 6 ppm, 0° to 50°C ambient.
Temperature Coefficient: ±0.1 ppm per °C, 20° to 30°C ambient.
Aging: Less than 0.1 ppm per week.
GATE: (Counting Times) 0.01 sec, 0.1 sec, 1.0 sec and 10. sec.
DISPLAY TIMES: 0.16 sec to 10.24 sec in binary sequence, plus "hold" position.

DATA OUTPUT: 10-line for each decade

PRICE: Type 1144-A 100-Mc Digital Frequency Meter . . . complete . . . $1995.
Type 1144-AP, same as above, but with data output . . . $2050.
Type 1153-A 10-Mc Digital Frequency Meter . . . $1495.
Type 1156-A Decade Scaler . . . $490.

Prices shown apply in U.S.A.

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Letters to the Editor

Sir,

Having recently been introduced to your magazine with the April 65 issue, I have found several articles listed in the index to Vol. 19 in which I would be interested.

Do you provide facilities for the obtaining of past articles, or back numbers of the magazine? Also could you advise me of an adequate parts supplier in Auckland, because there seems to be a lamentable dearth of parts suppliers in Hamilton.

I enclose your card with the request for 1 years' supply of the magazine.

M. G. DONNELL,
Melville, Hamilton.

We can in most cases provide back copies since 1961 — or at least copies of the articles required. With reference to inquiry for parts suppliers we would refer you to regular advertisers in our pages.

—Ed.

SQUARE WAVE GENERATOR

The transistor types mentioned in the text (OC 71) are correct and it is regretted that those down on the drawing did not match the text. The OC 45's in the drawing perform quite satisfactorily but OC 71's give better H.F. performance.

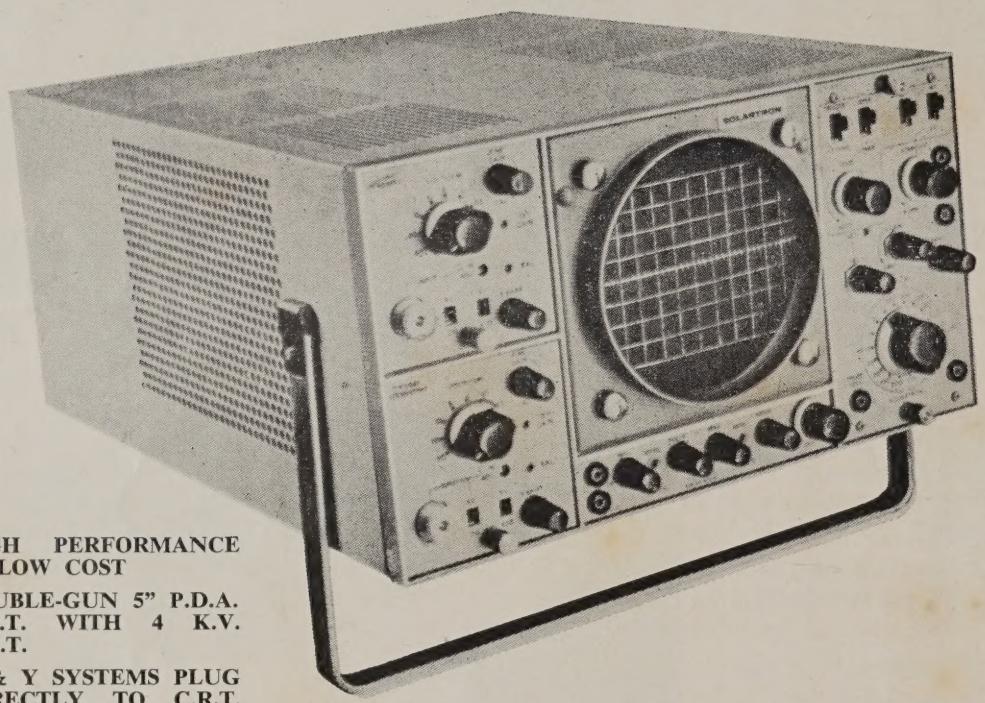
Keen readers will be aware that the capacitor values were interposed for the low and high ranges.

ENQUIRY CARD AD. 10

SOLARTRON

5 inch PORTABLE DOUBLE-BEAM OSCILLOSCOPE

CD 1400



- HIGH PERFORMANCE — LOW COST
- DOUBLE-GUN 5" P.D.A. C.R.T. WITH 4 K.V. E.H.T.
- X & Y SYSTEMS PLUG DIRECTLY TO C.R.T. PLATES
- WIDE-BAND & DIFFERENTIAL PLUG-IN AMPLIFIERS
- 10 cm X 8 cm GRATICULE ILLUMINATED RED or WHITE
- DUAL RANGE CALIBRATOR
- BENCH or RACK MOUNTING
- PORTABLE EASY to CARRY
- SIMPLE CAMERA FITTING

The new Solartron model CD 1400 is a low cost portable Oscilloscope System employing the latest 5" double-gun PDA cathodoray tube to give large, bright, high resolution displays at all sweep speeds. To provide maximum flexibility both the X and the two Y Systems plug in and drive the CRT plates direct. Power supplies are conservatively rated enabling any combination of plug-in units to be used and allowing for future development of additional units. Two types of cases are available for bench use or rack mounting.

The bench case has a wide carrying handle which may be used as a tilt stand.

For full information on the Solartron CD 1400 Oscilloscope, write to the Sole New Zealand Agents:—

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ENQUIRY CARD AD. 11

INTRODUCING THE REDFERN ELECTRONIC REGULATED 12 VOLT BATTERY CHARGER

SELF PROTECTED FROM SHORT CIRCUITING OR REVERSE POLARITY

This charger provides a precisely controlled charge for 12V batteries used on emergency power supply systems, such as fire alarms, lighting no break power supplies for radio telephone base stations, telephones, and as a regulated charger in workshops for repair to mobile and marine radio equipment. This charger is ideal for use with Redfern No-Break Inverter Power Supplies.

The charger employs an electronic sensing circuit which cuts off charge when the terminal voltage rises to the full charge value. The unit has a fast recharge characteristic which quickly restores charge on batteries called upon to produce short periods of heavy demand interspersed between long idling or stand-by periods, such as occurs with occasional mains failure.

The charger will not produce output voltage unless a battery of correct polarity is connected; this feature gives complete protection against accidental short circuiting or reverse polarity of battery leads.

The charger protects against overcharging, ensuring prolonged battery life and is completely automatic in operation, overcoming the many disadvantages of normal chargers.

Circuit: A silicon diode bridge rectifier is employed. Silicon transistors and diodes are used in the control circuit.
Controls: Push button selection of the following charge functions:
(a) Regulated low, charge starts at 1-2 Amps tapering to zero at cut-off. Used for low capacity lead acid or nickel battery charging.
(b) Regulated high, this is the normal charge setting used with lead acid batteries, charge commences at 20-25 Amps, depending on state of battery, tapers off to zero at cut-off. If battery terminal voltage falls below cut-off, charge automatically comes on.
(c) Continuous charge, this facility converts unit to unregulated charging, max. charge rate 20-25 Amps.
Fittings: Each charger has a mains on-off pilot lamp indicator, approx. five feet of charging cable provided. Two fuses, front panel battery fuse, 30/35 Amperes, internal three Amp. 230V fuse. The battery fuse is fitted to protect charger from possible damage through attempted charging of single 6V or parallel connected 12V batteries.
Mechanical: Weight 23 lb. Dimensions: 10¼" x 7¼" x 9½". 4" carrying handle.
The silicon diodes are mounted internally on heavy, insulated aluminium heat radiators.

MANUFACTURERS & DISTRIBUTORS

REDFERN RADIO

113 Great North Road, Glen Eden, Auckland

Redfern Transistor Inverters

Ideal portable A.C. power supply for mobile operation of soldering irons, lamps, radio receivers, transmitters, amplifiers, test instruments, emergency power supply. Unit will operate many T.V. receivers.

Maximum Load 200 Watts. Suitable for Boats, Caravans, Vehicles, Emergency Power.

230 V. 50 C.P.S. A.C. Supply from 12 Volt Accumulators

ENQUIRY CARD AD. 12

ENQUIRY CARD AD. 13

ELECTRONICS AT SEA

a precaution—

as well as a luxury

In this issue, which is largely devoted to marine equipment, we have endeavoured to show the increasing use of electronics in the marine world — from ocean going vessels down to the 16ft. runabout.

The use of radio telephones, radar and the like is an accepted thing on large ships where international standards of safety must be obeyed but at the other end of the scale there are no international requirements, nor even local requirements, that lay down minimum safety requirements at set for small boats.

Providing customs and immigration regulations are followed one could attempt to sail to Tasmania or Timbuctoo with absolutely no navigational or radio aids on board. This is unlikely, but what is likely is that two or three day cruises are carried out in local waters in similarly unequipped small boats at times when weather is variable. New Zealand, despite its pleasant climate, can provide quite rapid changes of weather conditions.

Apart from navigational tracking equipment such as compass, maps and sextant the minimum requirement for yachts or launches undertaking "outside harbour" cruises should be a seaworthy radio receiver capable of receiving the marine R-T frequencies in combination with a transmitter capable of emitting **at least** on the distress frequency. Some schools of thought say that the broadcast band should not be included in such an R-T set as frequent listening to broadcast stations will waste battery power. However, transistor receivers make such a suggestion a little too rigid. The truth is too, that the broadcast band facility is often what sells the set.

It has been said that New Zealanders are a nation of small boat lovers, and statistics show that this same nation is comfortably off but not rich so that boat owners, on the average, can only spend in a limited fashion. Thus, price comes into the question of marine equipment.

In this issue, therefor, we have examined existing services and endeavoured to formulate some requirements for marine equipment and examine briefly equipment currently available on the market.

The application of electronics to marine communications and the marine industries, such as fishing, is as wide open as other fields and we have given examples in these fields as an indication of the place of electronics in the marine world. With increased demand and miniaturisation the equipment found at present only in the larger seagoing vessels will, in six or eight years time, find a place in the larger pleasure craft.

However, apart from these desirable advances there is still considerable work to be done to improve existing equipment types. At the time of writing it appears that there is no waterproof small boat radio telephone set on the market and the place where most sets are fitted — the cockpit bulkhead — is likely to be showered in a rough sea. Similarly, the same positioning of a set is often an injury hazard in a rough sea as crew members may be thrown against the sharp edges of a set. Again, ease of operation, could be improved either by greater use of fixed tuning for the marine frequencies or using the transmitter crystal oscillator as a "net" to tune against.

The use of V.H.F. frequencies for local pleasure boat services may yet be necessary and they would certainly bring appreciable design advantages but costs may be on the high side.

Price appears to be the main barrier to pleasure boat owners, even to many commercial operators, and we feel that a manufacturer who could offer a reliable marine Radio Telephone set at £50 or below would be in clover.

COMMUNICATIONS — for small ships

By IRVING SPACKMAN

At this time of the year, many of the country's large number of yachtsmen, and owners of powered pleasure craft are putting their boats into the water for the summer season. A proportion of these boats are equipped with a considerable amount of electronic equipment, while others are content to sail with just a transistor radio to receive the time and weather services, and many boats put to sea with no electronic equipment of any kind on board.

Some of our readers, no doubt, will be considering the installation of some kind of ship to shore communications, and we trust that you will find the information in this and succeeding sections of valuable and timely interest.

To all our maritime readers, whether you have radio equipment or are contemplating such an installation, we would commend the information in the first article as it affects all radio users, particularly when "The safety of life at sea" is involved. Whether your radio equipment is a trusty old veteran made for use during World War II, or whether it is a new, partly transistorised transceiver, or whether you intend to install such equipment, please remember at all times that the radio equipment is basically installed for the convenience and the safety of you, your family and friends, and more particularly — for the other fellow! While you are talking, someone else could be in trouble.

What you say and the way you say it, is heard by many others, and you will be judged by what you say. There is a standard and an established procedure for all calls. Used correctly, it will save your time, your battery, your temper, and if in an emergency you need help, the established procedure will secure assistance more quickly. Imagine yourself in the position of urgently needing assistance, and trying to get it on a channel cluttered with unnecessary chatter. Don't forget, the silent periods must be observed at all times. If you are not fully acquainted with all the requirements and procedures, your local Post Office Radio Division will be only too glad to give you the necessary information.

Information following covers basically the fundamental details and is published for your guidance and ready reference. We suggest that this and following pages be removed from this journal and made into a durable booklet which should be kept near your transceiver, ready for instant reference.

Post Office Coastal Station Broadcasts:

The New Zealand Post Office maintains three radio stations whose primary purpose is communication with radio-equipped boats. These stations make a number of broadcasts daily at the times shown below. A preliminary call and announcement is made firstly on a frequency of 2182 kc/s, and then the broadcast is made on the working frequency at the times shown. (All times are shown in N.Z. Standard Time, which starts at midnight. For example, 0615 is 15 minutes past 6 in the morning and 2045 is fifteen minutes before nine at night.)

(1) A special forecast for areas, Whangarei to Cape Rodney, including Great Barrier Island, Hauraki Gulf, and Auckland Harbour, is broadcast from Auckland Radio on 2206 kc/s at 0809 and 1609.

(2) Radio Telegram Traffic for Small Ships: Each of the above stations calls shipping with messages upon receipt, before and after each weather broadcast, before broadcasting navigations warnings and also at the times shown.

	Radio Auckland	**Radio Wellington**	**Radio Awarua**
Call Sign	ZLD	ZLW	ZLB
Working frequency	(2206 kc/s)	(2152 kc/s)	(2206 kc/s)
Coastal weather reports [See (1)]	0735 1935	0725 1925	0740 1940
Weather forecasts for 24 hours from time of broadcast	0918 2118	0848 2048	0903 2103
Storm and gale warnings	0225 1425	0220 1420	0235 1435
Navigation warnings	0009 0409	0006 0406	0003 0403
	0809 1209	0806 1206	0803 1203
	1609 2009	1606 2006	1603 2003
Traffic calls [See (2)]	1240 1640	1220 1620	1235 1635

Private Coastal Stations:

In addition to the three stations which are manned 24 hours a day, seven days a week, there are a number of private small ship coastal stations licensed throughout New Zealand. These stations usually observe regular hours of watch on 2045 kc/s and also during their hours of operation are required to maintain a listening watch on 2182 kc/s.

Location of Station	**Call Sign**
Akaroa	ZLNG
Awanui (Unahi)	ZLNF
Banks Peninsula	ZLHH
Dargaville	ZLCM
Doubtful Sound (Te Anau)	ZLCE
Gisborne	ZLDL
Greymouth	ZLHJ
Helensville	ZLHZ
Havelock	ZLLU
Jacksons Bay (Okuru)	ZLJA
Kaikoura	ZLNR
Kawau Island	ZLSU
Kawhia	ZLLL
Kerikeri	ZLCG
Leigh	ZKUV
Maketu	ZLUK
Mayor Island	ZLNO
Mercury Bay	ZLNS
Nelson	ZLNI
New Plymouth	ZLHP
Onerahi	ZLAY
Oneroa	ZLDH
Opotiki	ZLCO
Otakou	ZLDA
Otehei Bay	ZLAX
Owaka	ZKZJ
Owenga	ZLDD
Paihia	ZLLX
Ponui Island	ZLLP
Port Albert	ZKUO
Port Charles	ZINQ
Port Chalmers	ZLHF
Raglan	ZLJS
Rotoroa Island	ZLRT
Ruawai	ZLTA
Russell	ZIRC
Stewart Island (Half Moon Bay)	ZLRZ
Taieri Mouth	ZLRY
Takatu Point	ZLQU
Tauranga	ZLHT
Tatapouri	ZLUG
Thames	ZLSV
Timaru	ZLHI

Tutukaka	ZLDW
Unahi (Awanui)	ZLNF
Wanganui	ZLTQ
Waipu	ZLJL
Wanaka	ZLKC
Westport	ZLLC
Whakatane	ZLRE
Whangamata	ZLRH
Whangarei	ZLHG
Whangaruru	ZLLM
Lake Rotorua	ZLVK
Lake Taupo	ZLHE
Lake Te Anau	ZLRJ
Lake Waikaremoana	ZKUE
Lake Wakatipu	ZLYU

In addition, the Coastguard Service in the Auckland area is licensed for two-way communication only with bonafide Coastguard auxilliaries on 2128 kc/s.

THE SILENT PERIOD:

This is exactly what is meant — All stations must keep silent — and off the air on any frequency between 2167 kc/s and 2187 kc/s for **three minutes commencing on every hour, and half hour N.Z.S.T.** Only distress, urgency or safety transmissions are permitted on any channel between these two frequencies during that time. The regulations state that all radiotelephone stations of the maritime mobile service licensed for operation in the frequency bands between 1605 kc/s to 2850 kc/s shall **during their hours of service** keep watch on 2182 kc/s twice each hour for three minutes commencing the hour and half hour New Zealand time.

It is particularly important that an accurate check of the time, is made before transmitting on 2182, for this reason, and accordingly it is suggested that an accurate clock be kept handy. There is no excuse for incorrect time as time checks are readily available on request from the nearest coast station.

Frequency Usage:

The various frequencies listed below are listed together with the particular kind of operation which is permitted by the N.Z. Post Office. Non-observance of these details can at the least, cause unnecessary confusion and annoyance, and at the worst, interfere with the handling of distress or emergency traffic.

2182 kc/s

All ships using radiotelephony in the 1605-2850 kc/s range must make provision for transmission and reception on this frequency. **2182 kc/s is the international distress frequency.** It is used also as a calling frequency by Post Office coast stations, Harbour Board stations, and ships handling public correspondence.

2045 kc/s

For calling between ships and the privately-operated coast stations. Note:—It is desirable that usage should be confined to calling and reply, subsequent communication being carried out on working frequencies. (See also 2480 kc/s and 2444 kc/s below).

May also be used for **calling** other ships equipped with 2045 kc/s.

2162 kc/s or 2012 kc/s

For use by ships when sending messages to Post Office coast stations or Habour Board stations after communication has been established on 2182 kc/s. Also for use by Harbour Board stations as a working frequency.

2068 kc/s, 2456 kc/s, 2638 kc/s

For inter-ship working after communication has been established on 2182 kc/s or 2045 kc/s.

2480 kc/s

For use by ships for sending messages to privately-operated coast stations after communication has been established on 2045 kc/s.

2444 kc/s

For use at privately-operated coast stations for sending messages to ships after communication has been established on 2045 kc/s.

2206 kc/s

Used by Auckland Radio and Awarua Radio for sending messages to ships after communication has been established on 2182 kc/s; and for the transmission of navigation warnings and meteorological broadcasts following a preliminary call on 2182 kc/s.

2152 kc/s

Used by Wellington Radio for sending messages to ships after communication has been established on 2182 kc/s; and for the transmission of navigation warnings and meteorological broadcasts following a preliminary call on 2182 kc/s.

DISTRESS MESSAGES:

Any distress, emergency or call regarding the safety of life or craft at sea should be made on 2182 kc/s, except if it is known that the nearest ship or coast station is actually listening on 2045 in which case this frequency can be used.

The Distress Call has absolute priority over all messages. If difficulty is encountered, the Distress Message is most likely to be heard on 2182 kc/s during the silent periods of 3 minutes after the hour and half hour, as all stations are maintaining a listening watch at these times.

The DISTRESS CALL is to be used when the boat or ship is in grave or imminent danger and requests immediate assistance.

The call is MAYDAY (spoken three times) the words THIS IS, the NAME and CALL SIGN of the ship.

The Distress Call should be followed as soon as possible by the DISTRESS MESSAGE. This message consists of —

(1) THE NATURE OF DISTRESS AND HELP REQUIRED.

(2) THE POSITION OF THE SHIP (use here either latitude or longitude, or where practicable, a true bearing and distance from a known geographical point).

(3) Any other information of value to vessels coming to help.

A ship making a Distress Call should, if possible LISTEN ON THE FREQUENCY ON WHICH THE CALL WAS MADE for a reply.

Make sure that your receiver is tuned correctly to receive the reply. If you cannot get an answer on 2182 kc/s or 2045 kc/s, it is then in order for you to use other frequencies which you have available on your transceiver. In any event, return at frequent intervals to 2182 and make your call again. Don't forget also, that if you are using a receiver which is manually tuned to the various frequencies, then this could not be exactly on tune, or it could have become displaced slightly under the stress of the emergency.

If any other station comes on to the frequency, other than to reply to your Mayday Call, then you can clear the channel by saying "SEELONCE MAYDAY".

EMERGENCY MESSAGES:

If there is an emergency, which does not require a Mayday call, but concerns the safety of a ship, some person on board, or within sight, then the URGENCY SIGNAL should be used.

Transmit on 2182 kc/s (or any other likely frequency, such as 2045 kc/s if no reply can be received on 2182 kc/s) using the word PAN (spoken three times) then give NAME OF SHIP AND CALL SIGN (spoken three times) then MESSAGE. Listen on the frequency you transmit on, for a reply.

All stations hearing an Urgency Signal must take great care not to interfere with the Urgency Call or any following messages.

SAFETY MESSAGES:

If you have a message which concerns the safety of a ship or navigation, or an important meteorological warning, then make the call in the normal manner on 2182 kc/s, but preceed the call with the words SECURITE (pronounced "SAY-CURE-E-TAY" spoken three times.

URGENT MEDICAL ADVICE:

Urgent medical advice can be obtained from any Post Office station by addressing a message to the station concerned. The coast station will forward the message to the appropriate medical authority whose reply will be passed to the ship.

WHAT TO DO IF YOU HEAR A DISTRESS MESSAGE:

1. LISTEN CAREFULLY, and if possible write down the message and the time.

2. LISTEN FOR A REPLY AND ACKNOWLEDGEMENT from a Coast station.

3. If no reply is heard, after a reasonable time acknowledge on the frequency you are listening to.

4. Then relay the message by saying the call MAYDAY RELAY (spoken three times) then give your ship's name and call sign (spoken three times). Then give the Distress Message **exactly** as it was broadcast, not your own version of it.

Also render assistance, if possible advising both the Coast station and the Distressed Vessel of your actions. If you give your distress message on a frequency other than the one used by the Distressed Ship, then you should also indicate what frequency was used for the distress message, and the time the message was received.

It is most important that all stations not engaged with distress traffic, cease transmissions immediately. When distress traffic has ceased and silence is no longer required, the coast station which has controlled the distress communications, will clear the frequency for normal operation with the following message:

MAYDAY — TO ALL STATIONS, THIS IS (Call sign of Coast station) THE NAME AND CALL SIGN OF STATION WHICH WAS IN DISTRESS, the words SEELONCE FEENEE.

* * *

DO YOU KNOW THAT :—

An explosive gas is given off when your battery is charging. **KEEP OPEN FLAMES AWAY** and do not cause a spark by breaking any connection to the battery with current passing through the circuit.

The best way to check your boat battery is with a hydrometer. Place it on charge before the hydrometer drops to a reading of 1.225.

The present short range radio message service rate is 9d. per word for telegrams exchanged with small ships.

Radio-Telephones in New Zealand

To give readers and intending purchasers of a marine radio-telephone some indication of the types available in this country, we will try to cover some of the salient points worth keeping in mind.

With the widespread use of semi-conductor devices such as transistors throughout the electronics industry, it would be a sound assumption to expect much of the modern radio-telephone to be "solid-state".

This is in fact the case. Fully transistorised receivers are the rule, whilst on the transmitter side, in many cases, the only vacuum tubes will be found in the R.F. section, with modulators and DC to DC converter also transistorised.

The transistor has proved to be mechanically and electrically a rugged device provided it is not abused in a way that the manufacturers specifications are exceeded. Generally, unless vastly overrated, (with attendant high cost) it will however not stand voltage or current overload, the application of incorrect battery polarity or extremes of temperature. It is for these reasons that practically all the marine transceivers on the market today incorporate some form of incorrect polarity, and DC, and RF overload, protection.

The major advantage of "transistorisation" is the great saving in battery power consumed, particularly, in the receiver which now can be left running for long periods without discharging the battery. There is less heat generated due to the virtual elimination of vacuum tube heaters. Even the DC to DC conversion systems using transistors are more efficient than the vibrator or rotary converter.

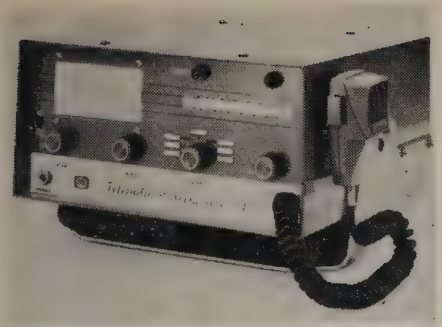
Virtually all the available Radio-telephones are designed to operate on a 12 volt system. Some of the higher powered versions are also available for operation from a 24 volt battery line.

Technically N.Z. designed and manufactured Marine Radio-Telephones are as up-to-date as those in any part of the world. One manufacturer recently received an order for 50 of their High Power units for export to Australia and the Pacific Islands.

To ensure this high standard, all manufacturers produce their equipment up to, and generally better than, a specification which was introduced by the N.Z. Post Office, in 1964. This specification sets rigourous requirements on receiver and transmitter performance and reliability, overload protection, and operator convenience. The transmitter in all cases must be crystal controlled for stability with a minimum of five frequencies available, one of which must be the International Frequency of 2182 kc/s.

Most of the receivers cover the Broadcast Band in addition to the Frequency range 1605 kc/s to 2850 kc/s (2000 kc/s to 2850 kc/s is acceptable). Some of the receivers cover the marine frequencies with a continuous tuning range, with the marine frequencies easily identified, whilst others (generally more expensive), have the receiver crystal controlled along with the transmitter.

As examples of the various types of units available in this country, we have selected four, from various manufacturers in this country. Our selection of these does not how-



Left: AWA Teleradio 65; Centre: Marlin Tiros II; Right: A typical English Coastal Set

ever, indicate a particular preference on the part of the editorial staff, but serves merely to illustrate various designs and techniques.

The "Marlin" Oscar 2: This is perhaps one of the smallest units physically, and it is mounted on a metal gimbal bracket. The fully transistorised receiver, continuously tunes both the broadcast and shipping band (2.0 to 2.7 mc/s), and consumes a maximum of 400 milliamperes from the 12 volt battery giving an audio output of approximately ½ watt. The transmitter and modulator use vacuum tubes, with an input of 30 watts, to the final stage. The high voltage for the transmitter is produced by a vibrator supply.

All necessary controls are available from the Front Panel, with Transmit/Receive switching controlled by the microphone pressel switch. A transmit/Off-Standby switch is included so that the filaments of the transmitter can be turned off when only the receiver is required, thus effecting a considerable saving in battery consumption.

The recommended aerial to be used with this equipment is a length of wire in the form of an "inverted L", no longer than ¼ wavelength, at the highest working frequency.

The "Teleradio" 35: This is also a single unit, compactly designed and cradle mounted. The unit operates on a 12 volt supply, with a fully transistorised receiver continuously tuning the broadcast band and the marine frequencies of 2-3 megacycles; the band selection being effected by a front panel switch. The receiver is capable of one watt audio output. The transmitter is crystal controlled with five channels available (unit normally supplied with crystals for three channels). The transmitter and modulator use vacuum tubes, with power input to the transmitter final stage of 35 watts. D.C. to D.C. conversion is by means of a transistorised converter with the 12 volt D.C. line polarity protected. The transmitter filaments can be turned off with the receiver remaining operational to save battery power (current consumption on transmit-standby is two amps). It is recommended that the transceiver be used with the matching fibreglass whip antenna and antenna coupler which is said to eliminate the requirement for an earth plate on the outside of the hull.

The "Teleradio 65": Four basic models of this unit are manufactured. Models for 12 and 24 volt supply, and marine band coverage of 2-3 mc/s and 2-8.5 mc/s are produced.

The receiver in these units as in all the others, is fully transistorised, drawing a maximum of 300 mA from a 12 volt battery for an audio output of more than 1 watt, which can be fed to an extension speaker if desired. The receiver is continuously tunable over the broadcast band, with front panel of up to 6 crystal controlled marine frequencies. Fold out printed wiring boards are used in the receiver and modulator speech amplifier. The I.F. section employs a 6 kc bandwidth mechanical filter.

The transmitter covers six channels, crystal controlled, front panel switched with the receiver, and runs 75 watts input into two parallel tubes in the output stage. All switching in the transmitter is done with heavy duty ceramic wafers. The modulators are fully transistorised, and the frequency response of the audio is filtered for maximum intelligibility even under weak signal conditions. The D.C. to D.C. high voltage converter also uses transistors and an encapsulated toroidal transformer.

The transceiver can be operated with a long wire aerial (not longer than ¼ wavelength at the highest frequency) on sailing or motor vessels with a mast, or with a base loaded 12 foot whip on launches etc. with no mast.

The Marlin "Tiros" Mk. 2: These units are available both for 12 volt and 24 volt battery systems. Here again we have a compact single unit transceiver fully transistorised except for the R.F. section of the transmitter. The receiver is continuously tunable on the broadcast band, and also covers 6 spot frequencies in the 2.0 mc/s to 6.0 mc/s marine band with crystal controlled accuracy. The receiver requires 0.4 amp from the battery at full audio output. One feature of the receiver is a panel operated squelch control which enables the receiver to be quilted during listening watches, yet enables any station to be heard on that channel immediately it commences transmission.

The transmitter is also crystal controlled on six spot frequencies in the marine band, switched together with the receiver, and runs with a maximum of 100 watts input power. Both the modulator and the D.C. to D.C. converter are transistorised and all transistorised equipment is protected against excessive, and under voltage operation, or incorrect battery polarity. All controls are brought to the front panel and easily identified and a moving coil meter is provided for accurate transmitter tuning.

Transmitter power can be reduced to save battery drain if desired by the use of a low-high power switch.

The recommended aerial for this unit is a single wire type in the form of an "inverted L", but the length of this should not exceed ¼ wavelength at the highest working frequency.

● **CORRECTIONS TO "A TRANSISTORISED STEREO AMPLIFIER SYSTEM"**

One component was missing from the pre-amplifier circuit — namely a 47 k ohm ¼ watt resistor connected between the positive supply line (junction 470 ohm and 3.3 k ohm decoupling resistors) and the base of the last 40233 junction 6.8 k ohm resistor and positive side 25 mfd electrolytic).

The 1 watt 1 ohm resistors used in the emitters of the 40310's and as surge limiting resistor in the power supply were made by winding a 5 inch length of 32 s.w.g. constantam wire on a high value 1 watt resistor.

The final part of the article on a Transistorised Stereo has been held over due to the special marine feature.

Marine Radar

Radar is an English invention. The word 'Radar' was derived from the first letters of Radio Detection and Ranging. It is best known as an electronic aid to marine navigation, but it is utilised as well for airways surveillance, weather forecasting, storm detection and for aircraft navigation. In marine use, radar is used for positional checks and to avoid collisions. The great advantage of radar is that it provides this information regardless of visibility or weather conditions.

The principles of radar are simple. A transmitter generates short pulses of super – high – frequency radio energy, and these are radiated by a directional aerial. When one of these pulses hits a coastline or ship, a part of the pulse was 50μsecs (50 millionths of the directional aerial). This is the 'echo'. The time between the transmission of a pulse and the reception of the echo can be measured and converted into distance. For example, if the time between the transmission and reception of a pulse was 50 μsec (50 millionths of one second), the distance travelled would be 50 x 328 = 16,400 yards. (The speed of radio waves is approximately 328 yards per μsec). Since the pulse has travelled to and from the target, the range to the target is 16400 yards

$$\frac{}{2}$$

= 4.6 miles.

If the directional aerial is rotated at a constant speed, and the pulses transmitted at a high rate, the whole horizon will be scanned. The echoes produced by targets are 'painted' on the fluorescent screen of a cathode ray tube by an electron beam — similar to the way a TV picture is produced. The result is a radar picture of the area around the aerial.

The basic units of a marine radar system are shown in figure one.

The cathode-ray tube in the display unit (referred to as a plan-position indicator – PPI) has a circular screen, and the electron beam painting the radar picture moves radially in synchronism with the directional aerial. Calibrated range rings are usually provided at fixed intervals to simplify range measurement.

The transmit/receive switch allows one aerial to be used for both transmitting and receiving. It's purpose is to protect the receiver from the very high power transmitted pulse, and to allow the very weak received pulse free passage to the receiver. Since pulses are transmitted at a very high rate, (between 500 and 2000 pulses per second), the switch must be capable of changing from transmit to receive reliably at the same speed.

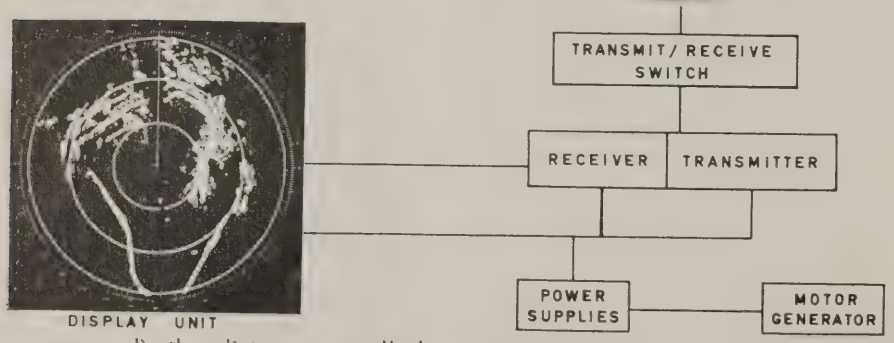
The pulse rate referred to above is called the 'pulse repetition frequency' – P.R.F. Another important factor about the pulse is its length i.e. the time between the start and finish of each pulse. Pulse lengths on marine radars vary between .06 and .5 μsec. The PRF and pulse length are usually selected automatically according to the range in use — a high PRF (2000 pps) and a short pulse length (.06 μsec) for short ranges, and a low PRF (500 pps) and a long pulse length (.5 μsec) for long ranges.

The choice of pulse length dictates the shortest range at which an echo can be received. A pulse of .5 μsec is 164 yards long (.5 μsec x 328 yds/μsec). In other words, when the end of the pulse is just leaving the aerial, the leading edge of the pulse is 164 yards ahead. Since the transmission must be complete before the transmit/receive switch can change over to receive, no echoes will be admitted to the receiver from a range of less than 164 yards. The .06 μsec pulse has a length of 20 yards, and so allows very short-range echoes to be received.

Switched pulse repetition frequencies compensate for the difference in the amount of power transmitted on short and long pulse lengths. A transmitter generating a pulse of .5 μsec at a PRF of 1000 pulses per second is actually transmitting for only .5 μsec x 1000 = 500 μsec each second. If the pulse length is switched to .2 μsec the transmitter is 'on' for only 200 μsec each second. The amount of effective power radiated will be much less, and the echo strength will be reduced. If the PRF is raised to 2000 pulses per second, the transmitter 'on' time is 400 μsec per second.

Since these short pulses are used only on short ranges (generally under three miles), the smaller

Figure One



amount of energy radiated is not so important.

A typical marine radar installation comprises four main units:

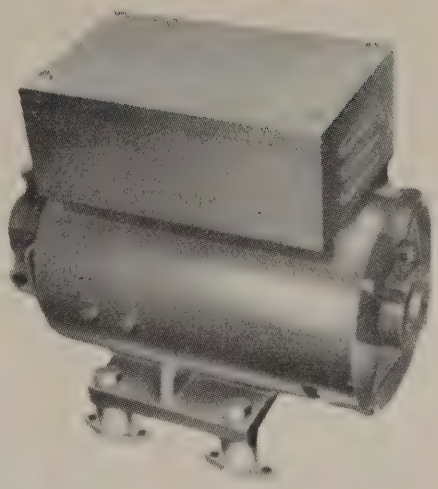
(1) The motor generator and associated regulator, which provides the high–frequency alternating current for the radar. The regulator maintains a constant output voltage despite variations in the ship's mains voltage.

(2) The transmitter/receiver unit, which contains the radar transmitter, receiver, transmit/receive switch, and power supplies. It is generally mounted in a protected position close to the aerial.

(3) The aerial, or 'scanner', which is mounted on a mast or platform with a clear view all round the ship.

(4) The display unit, which contains the cathode ray tube, is normally mounted on the bridge where the navigator has a clear view straight ahead.

Modern radars make full use of transistors and solid state techniques. The following discussion outlines the technique and capabilities of a typical new radar — The



Kelvin Hughes Type 17 which is illustrated.

The complete equipment consists of the four basic units described above — scanner, transmitter/receiver, display unit, and motor–generator. It provides eight scale ranges extending from ¼ mile to 24 miles. Three pulse lengths are available, the appropriate pulse length being automatically selected by the range switch. In order to achieve enhanced brightness of the display on short ranges, alternative pulse repetition frequencies of 1,100 pulses/sec and 2,200 pulses/sec are provided for long and short ranges, the higher PRF being automatically brought into operation on all ranges from ¼ mile to 3 miles. Calibration rings are provided on all ranges.

The Standard Type 17 Scanner is a 6 ft. slotted waveguide unit having a horizontal beamwidth of only 1.2°. This type of Scanner, gives a high degree of range resolution,

resulting in a picture of high definition on short range. An alternative 4 ft. Scanner is available for very small vessels where the practical advantages of using a smaller Scanner outweigh the resulting loss in performance.

The equipment presents a high definition PPI display on a 9 inch cathode ray tube. An optical magnifier can be supplied to increase the size of the display to an equivalent of 12 inches. The equipment can be supplied for operation from 24, 32, 110 or 220V DC mains, and consumes approximately 350 watts from the ship's supply. For AC supplies an extra rectifier unit is available.

With the exception of the cathode ray tube, the whole of the Display circuitry is transistorised using Silicon transistors. It has been the policy during design to employ silicon transistors exclusively, as opposed to germanium transistors, the former being more robust and less affected by temperature variations.

Details of the four basic units are as follows:—

Scanner. The Standard unit comprises a horizontally–polarised 6 ft. end–fed slotted waveguide aerial encased in a fibre-glass envelope which is bolted directly to the turning mechanism, the whole forming one complete assembly. An alternative 4 ft. Scanner is available. Both Scanners have been tested successfully in a wind tunnel up to wind speeds of 120 knots.

Display Unit. This unit is splash proof and is suitable for bulkhead, deckhead or table mounting. The sides have been left free from protrusions so as to facilitate installation in corners or in close proximity to other instruments. In designing this unit special attention has been given to the position of the controls, those in constant use being

Continued on page 35.

A module approach to marine mobile radio-telephones

AUCKLAND HARBOUR BOARD F.M./V.H.F. RADIO-TELEPHONE SYSTEM

*by Peter Le Quesne**

The system described covers equipment for the International Marine V.H.F. Band of 156.025 to 162.025 Mc/s. This band is divided into 28 Channels, but only four channels are used by the Auckland Harbour Board; 8, 12, 14 and 16, the latter Channel being the V.H.F. Distress and Watchkeeping Channel. Besides the Band for Shipping, the Auckland Harbour Board maintains a private two frequency simplex channel on Mount Victoria in the 160 Mc/s Band.

The Base Stations and Talk–Through Repeaters consist of Cossor Type 121·50 watt transmitters (Deviation 15 Kc/s). The receivers are double conversion with electro–mechanical mute to open from a ·6 microvolt signal. Normal remote control facilities are offered.

Except for the Shipping Channel Station at Queens Wharf, all other equipment is on Mount Victoria about a mile across the Harbour and consists of dual transmitters and receivers in case of failure and for ease of maintenance. The Talk–Through Station is controlled by G.P.O. land line from three remote control units on the City side of the Harbour and all the multi–channel equipment is remote controlled including channel switching.

For monitoring purposes, a receiver tuned to Channel 16 is located two miles away at St. Leonard's Point, also controlled by G.P.O. land line. Its main purpose is to monitor any vessels that might be calling on Channel 16 whilst other channels are in use.

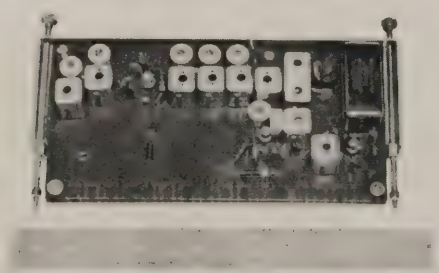
The Base Station aerial system consists of omnidirectional arrays in the form of folded dipoles. All aerials are mechanically identical and are placed on two masts with cross arms suitably spaced. All Base Station Equipment is of conventional valve circuitry but with solid state power supplies. Being British made, all equipment has type approved from the British Post Office, in addition to complying with local specifications.

Base Station Aerial System

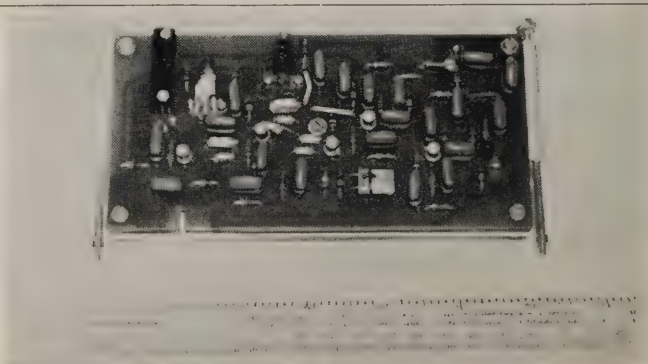
It is always of utmost importance that proper consideration be given to siting transmitting and receiving stations both from the range and interference aspect as unless care is taken serious interference may result from systems using several simultaneous channels or even independent systems working in close proximity to each other.

As a port communications system may call for the exchange of calls on a number of single frequency channels simultaneously (e.g. 12, 14, and 16) the use of these single frequency channels can present interference problems and the first and most obvious of these is that

* Coastal Radio (N.Z.) Limited. In conjunction with Raytheon Company, U.S.A., and Cossor Communications Company Limited, England.



V.H.F. Module



I.F. Module

of mutual interference or 'blocking' and separate transmitting and receiving stations a suitable distance apart must be used if this is to be avoided. For similar reasons both transmitting and receiving stations must be suitably set back from the nearest approach of the shipping lane so as to prevent passing ships blocking adjacent frequency shore stations.

Apart from the question of blocking there is the less obvious possibility of interference due to intermodulation. This form of interference is likely to be met in any frequency plan utilizing evenly spaced channels. In the case of simultaneous operation on channels 14 and 16 intermodulation will be produced on channels 12 and 18.

Any two operating channels can produce intermodulation interference on a third and it can be seen from the attached table that the two highest priority port operation channels 12 and 14 together produce an intermodulation product on channel 16, the safety and calling channel.

The most important intermodulation products resulting from pairs of Hague plan single frequency channels are given below:—

PAIRS OF SHORE STATION TRANSMITTER			INTERMODULATION PRODUCTS		
Channels	Frequencies	Function	Channels	Frequencies	Function
12/14	156.6 Mc/s	PO1	10	156.5 Mc/s	IS3
12/14	156.7 Mc/s	PO2	16	156.8 Mc/s	SC
12/16	156.6 Mc/s	PO1	8	156.4 Mc/s	IS2
12/16	156.8 Mc/s	SC	20	157.0 Mc/s	PO1
14/16	156.7 Mc/s	PO2	12	156.6 Mc/s	PO1
14/16	156.8 Mc/s	SC	18	156.9 Mc/s	PO3
11/12	156.55 Mc/s	PO3	10	156.5 Mc/s	IS3
11/12	156.6 Mc/s	PO1	13	156.65 Mc/s	PO4+IS4

Key to above chart:
PO = Port Operations SC = Safety and calling IS = Intership

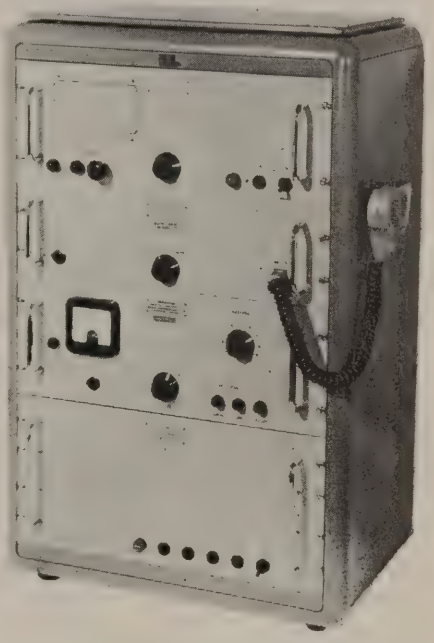
Example of Signal Strength Calculation

1. Transmitter 50W + 17dBW (dB re IW)
   Feeder loss —2dB (with UR57 cable)
   Aerial gain 0dB
   +15dBW E.R.P.
   Attenuation for horizontal Spacing for 2 wavelengths 35dB
   Feeder loss 2dB
   At RX then +15dBW
   —35dBW —2dB 22dBW
   as 1μV in 75 ohms represents —138dBW
   then —22—(—138) = +116 ref 1μV or 630 Mv.
2. For vertical spacing of 2 wavelengths we get 55db cross coupling attenuation and at RX previous figure of –22dBW becomes –42dBW (+96dB re 1μV) or 63M.W.
3. At 1 mile separation an attenuation of 75dB can be expected and that corresponds to **6.3 M.V.**

NOTE: The British Post Office Spec. TSC 53(d) states that signal to noise ratio of 20dB for wanted signal of 30mV ± 100Kc/s off tune.

Mobiles

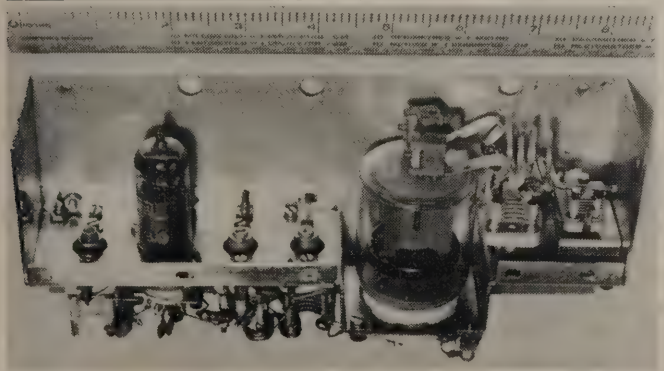
The mobiles are of two types and except for the transmitter R.F., are identical in all electrical aspects but mechanically different.



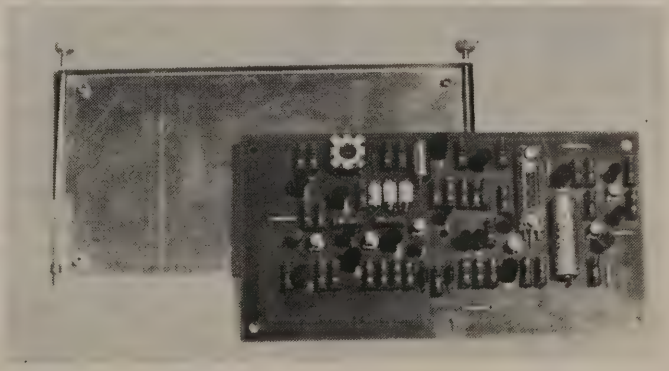
Both units are completely Module constructed with interchangable units.

Both units have fully transistorised receiver and transmitters except for the transmitter Driver and Power Amplifiers which are quick heating valves and give 70% of full power within 0.8 of a second from turning on. Both units are suitable for six channel operation with the mobiles operating on channels 8, 12, 14, and 16.

The Marine Version Cossor Type CC300M is completely waterproof and has remote control facilities and can be operated on 12/24 volt with either polarity to earth.



High Power R.F. Module



Backing Plate and Related Module Card

The Auckland Harbour Board installation has five 50 watt base Stations Type CC121 and 24 15 watt Marine Mobiles Type CC300M with 15 15 watt land Mobiles Type CC302 (plus extra channel 16 Receiver), six remote control units and appropriate aerial systems.

For interest a description of the module units is detailed and for all purposes refers to both CC300M and CC302.

The Modular Concept

The modular concept is not new to electronics or for that matter to the mobile radio business in particular. The approach taken by the suppliers however, is more comprehensive than any undertaken to date and furthermore offers some significant advantages to the user. The term module is now used freely with many different meanings and there is no universally accepted definition. Some manufacturers define a module as a circuit unit performing a single function, such as an amplifier with a constant impedance. Alternatively a module may be regarded as a circuit element of a minimal content, such as a single amplifying stage together with its coupling or tuning components. This latter is no doubt a flexible approach to the modular concept and in fact has been adopted by at least one manufacturer of mobile radio equipment. In addition to the high level of flexibility, modules such as these permit three dimensional packing, thereby utilising maximum available space.

On the other hand, manufacture of equipment made up in such a way presents certain difficulties. Perhaps of greatest importance is that the users have frequently complained that servicing is unduly complicated by the high density packing and multiple interconnections inherent is this approach. After considerable investigation Cossor determined, contrary to usual modular ideas to include in each module the maximum amount of circuit function consistent with the requirement for common use throughout the entire system. Further more, the division of the circuitry into modules was engineered so that control of the parameters requiring alteration to meet differing specifications or services was achieved by variation of very few modules, leaving the greater part of the system common throughout. These logical sub-assemblies (here-in called modules), are constructed using standard printed circuit technology and assembled into equipment by a plug–in technique. Special attention was paid to the plug–in feature, because it could have given rise not only to excessive materials cost but also to a built in lack of overall reliability. Extensive trials have demonstrated that the basic mechanical approach is not only economical but provides reliability at least equivalent to conventionally wired chassis. From the user's standpoint ease of servicing and the minimum of spares inventory resulted from this approach.

In a given radio telephone system, better than 80% of the modules will be interchangable between base stations, mobiles, and land mobile sets. At the point of service 'go' 'No go' tests may be performed to determine which modules can then be found faulty. Once the faulty module is isolated it is simply replaced and the equipment can be put back into service. Furthermore the faulty module can then be sent back from the field to a central servicing depot for repair, thus obviating the necessity of expensive investments in field personnel and test gear.

In all there are some thirty modules making up the complete range, however the bulk of these are variants on one or two of the following basic units: receiver and V.H.F. tuner, local oscillator, IF amplifier, supply, transmitter 25-50 watt power supply, 10 watt amplifier, 7 watt power amplifier, transmitter oscillator-transmitter multiplier, microphone amplifier and limiter, transmitter power supply, IF amplifier, A.M. detector, F.M. detector receiver audio and output.

It is not the intent of this article to provide the detailed circuit design but the following comments will bring out the more interesting features incorporated in the modules.

V.H.F. Tuner

This module includes the V.H.F. amplifier, vhf preselector circuits mixer 10.7 Mc crystal filter and one stage of amplification at 10.7 Mc. The crystal filter can provide all of the adjacent channel selectivity in the receiver. The filter can be readily changed to provide any channel spacing that might be called for. Special attention has been paid to the non linear characteristics of the tuner, resulting in a intermodulation figure of better than 70dB, while spurious responses are better than 90dBs. A photograph of the V.H.F. is shown in Photograph 1.

Local Oscillator

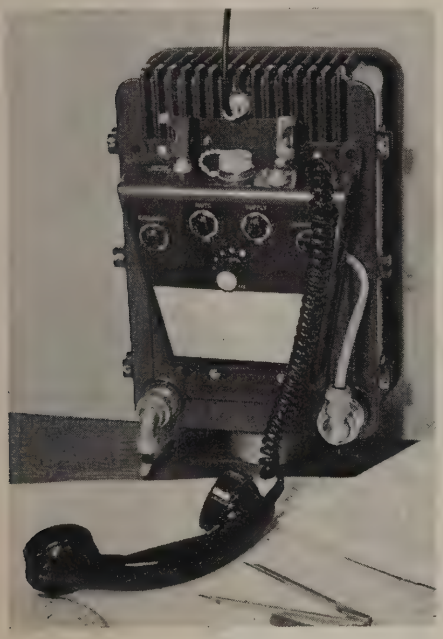
The local oscillator module provides facilities for switching crystal circuits for up to six channels. If more channels are required, two or more oscillator modules may be connected in one receiver. Third and fifth overtone crystals are used in the oscillator, a separate maintaining transistor being used for each crystal. The output circuits of all the oscillators are taken through a combining network to the mixer in the vhf tuner module. Diode switching is used to disconnect the power supply from the unused oscillators, thus elminating most problems associated with remote and local control.

IF Amplifier and Detector Circuits

The receiver is a double conversion superheterodyne. The I.F. amplifier module accepts the 10.7 Mc signal from the vhf unit and by crystal oscillator included in the

I.F. unit, converts the 10.7 Mc signal to 470 kc at which frequency it is amplified to a level suitable for operation of the detector circuits. The 470 kc I.F. amplifier is mainly resistance capacitance coupled with only one tuned circuit at 470 kc in the second mixer circuit. The I.F. module is shown in photograph 2.

Separate A.M. and F.M. detector boards are available, and inclusion of the appropriate unit is the only action required to provide either



A.M. or F.M. detection facilities. It is of course possible to have a piece of equipment containing both A.M. and F.M. detectors that can be selected at will by a switch. The detector boards include the squelch facilities in the case of AM impulse noise limiter and AGC circuits.

Receiver Power Units

One requirement which had to be met was provision for operation from nominal 6–, 12–, and 24 volt battery supplies, with either negative or positive earth or complete battery isolation. To ease the design of modules for use with various supplies, it was decided that dc converters should be used providing fixed secondary voltages for the modules. Stabilised rails of +10 and —10 volts are provided together with an unstabilised supply of 17 volts for the receiver audio output stage. Power supplies are of dual voltage 6/12 voltage and 12/24 volt both suitable for the modules with stabilised supply of 17 volts or the receiver audio output. Both are also suitable for either positive or negative polarity battery sources, providing complete isolation of the equipment casing and mountings from the battery supply.

Transmitter
Power Amplifier Modules

The power module is the only element of the range still containing valves. The two valves used are quick heating types and with filaments fed from the transmitter high tension converter. A single module is used for a 50 watt AM and FM and 10 watt AM and FM. The only difference is a valve change in the case of the 50 watt equipment. A second range of power amplifier module using a single valve, will provide 7 watts AM or FM and will be employed in an inexpensive under dash mounted equipment. A photograph of the higher power module is shown in Photograph 3.

Transmitter Oscillator

Up to six channels are provided by parallel mode crystal oscillators. A simple phase modulating circuit provides deviation at final frequency of 5 to 15 kc according to system requirements, with low distortion crystals switched in and out of the circuit of unused crystals. Several oscillators may be fitted if more than six channels are required.

Transmitter Multiplier

The transistorised multiplier circuits provide up to 0.5 watts, enabling them to drive the power amplifier modules direct. Some consideration was given to the use of a different oscillator multiplier arrangement for AM equipment when the high multiplication is not necessary. It was concluded, however that the economy resulting from the use of a common module for all transmitters outweigh other objections.

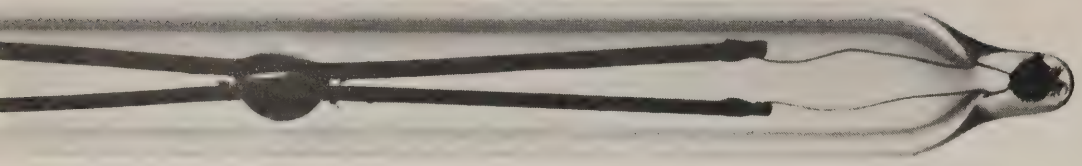
Transmitter Power Supply

The transistorised power supply is a transistorised transmitter converter which is driven from the receiver power unit. As well as providing high tension for the driver and power amplifier valves it also provides filament supply (square wave at approximately 420 cps) for two valves and safety for the power amplifier.

Mechanical Considerations

All modules except the high power stages are built on flat printed cards. Plug in edge connectors are used for the boards which are all mounted on common aluminium backing plates. The plates provide rigidity for the connectors and by coin operated screws, final locking in the module. Photo shows the backing and a related module card.

One of the design objectives was to ensure that the mobile equipment would be suitable for continuous transmitter operation and be dustproof and splash proof. This of course implied that louvres or the air vents were not acceptable and the problem of temperature rise within the case had to be overcome. Measurements indicated forcibly that special steps would have to be taken to keep the environment within the box acceptable. Heat elimination and control was achieved by mounting the power amplifier module directly on to a finned heat sink of cast aluminium which forms one side of the box containing the equipment and by providing a certain amount of thermal insulation between the power amplifier and remaining modules.



by Winston Lewis

Rapid Water Temperature Measurement With A Thermistor Thermometer

The electronic thermometer described was originally developed to measure the temperature and air flow in hot-running valve equipment where the small size and relatively quick thermal response of a thermistor were of value.

General

Whilst there is no doubt that electronic thermometers employing thermistors are more expensive than either liquid in glass or expansion–and–dial types they have certain advantages in remote indication and rapidity of response. Additionally, thermometers using electrical effects can be so designed that restricted ranges can be conveniently dealt with and the suppressed zero idea is an example of this.

A large number of semiconductor materials exhibit negative temperature — resistance dependency and the thermistor is a device where this property is put to advantage. The sensitive element is usually a bead of copper, nickel or manganese oxide that has been sintered at about 1000° C to 1500° C. Usually the temperature coefficient is between —2% / ° C to —5% / ° C. The relationship between resistance and temperature can be expressed

$$R_T = R_O \exp \frac{B}{T} \quad (1)$$

where R_T = resistance at T°K
R_O = resistance at absolute zero
B = constant for material

The temperature coefficient α can be derived from the above and

$$\alpha = \frac{B}{T^2} \quad (2)$$

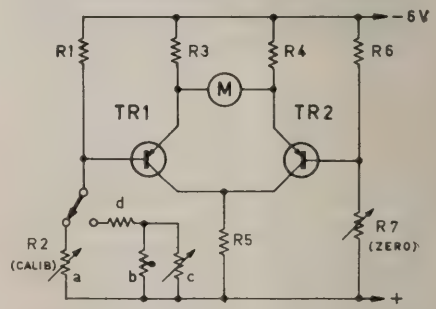
thus α decreases with increasing temperature.

The heating of the element can take place in two ways — externally or internally, that is; by the effect of the surroundings into which the thermistor is placed or by heat produced in the element by voltage across the thermistor. In practice, a combination of both usually take place and the relationship (2) above is modified by the current passing through the element.

Thermistors are manufactured in a number of envelopes and the most familiar will probably be the resistor–like element used in surge limiting applications or the disc type used as transistor circuit stabilisers. However, these two types are not particularly suitable as they cannot readily be used in aqueous liquids or humid situations. The type preferred for industrial measurements in liquids (including, here, air) is the glass bead or glass rod type shown in the illustration where the thermistor element is completely protected. In this type the bead of about twenty–thousandths of an inch in diameter is formed onto platinum wires and the whole bead imbedded in the glass tip. In this way best heat transference is achieved and rapid response to temperature changes is possible.

Measurement methods

Whilst a wheatstone bridge circuit has the merit of simplicity the out of balance current will depend upon the battery voltage in addition to the out of balance state. Good sensitivity would be achieved by raising the battery voltage but this will increase the current through the thermistor and increase the self heat with the consequent deterioration in the temperature—resistance curve and accuracy of indication. Hence, good sensitivity cannot readily be coupled to high accuracy.



Transistorised Circuit

However, wheatstone bridge circuits are used quite extensively industrially with circuit "tricks" to reduce the source of errors mentioned. As the temperature coefficient is inversely proportional to the square of the temperature a direct reading scale will be very non-linear and this is corrected by shunting the thermistor with a selected value of resistor. The failing battery voltage can be taken care of by using Mallory cells in which the end point is suddenly reached rather than the gradual drop off with standard torch cells. Wheatstone bridge instruments

have scale point adjustment potentiometers to take care of scale variations and usually setting up adjustments are done at the maximum end of the scale as here the current through the thermistor is at maximum and the self heating effect the greatest. A good industrial thermometer can give an accuracy of ·5° C over the range 0° C to 100° C.

Transistorised circuit

The circuit shows a pair of transistors having common emitter coupling. With (R1 and R6) and (R2 and R7) having equal values respectively the collector currents will be equal and for identical R3 and R4 there will be no out of balance current flowing through the meter.

As one element (R2b) of R2 is a thermistor a change in its resistance due to temperature change will produce a meter deflection.

Depending upon the sensitivity required this basic circuit can be used to provide a thermometer giving either a full range, restricted range or differential reading.

The lower the value of R2c shunting the thermistor the wider will be the temperature range, and sensitivity, of the instrument as a greater change in thermistor resistance will be necessary to overcome the effect of the shunt resistor.

Temperature difference can be read by making R7 another thermistor (of the same type) subjected to a reference condition, i.e. maintained at a constant temperature whilst R2b measures the required temperature. In this way it is quite easy to measure temperature differences of 3° C or 4° C and temperature gradients can be easily worked out.

A further elaboration is multi–point recording where a number of thermistors are switched in. By this means the temperature at a number of points can be read, for instance; engine water temperatures can be taken at the inlet, the manifold and outlet points. To use a common scale calibration individual R2d and R2c are required to compensate for variations in thermistor characteristics as the standard (20° C) values of thermistors are likely to vary by from 10% to 20% due to manufacturing tolerances.

"Set zero" adjustment may be either at full scale or zero scale depending upon requirements. Full scale adjustment will mean that maximum current will be flowing through the thermistor so the self–heating effect will be the greatest. Providing the thermistor current is low, say under 500 μA, self–heating errors should not be great.

Unfortunately the range of "glass" type thermistors available at present in New Zealand is not great and optimum values for transistor circuits are not easy to obtain and working resistance values around the 500 ohm to 1000 ohm may have to be achieved by increasing the thermistor current.

Practical considerations

Whilst the circuit detailed is capable of accuracy good enough for laboratory work it is felt that it has applications in many everyday situations and marine engines will be one situation where such a thermometer will be of value, particularly a multi-point version to monitor three or four water temperature points. The response time of about 5 seconds means that quick changes of temperature can be noted.

When built up for outside use it is suggested that the two transistors be mounted in a common heat sink; an example would be a small block of copper or brass with two holes drilled so that the transistors can be pushed in. This will allow the transistors to reach a common temperature (ambient air temperature) and each will then exhibit the same temperature drift and in the balanced circuit shown such effect should cancel out.

Better transistors (germanium) will also improve temperature effects.

Calibration can be done at freezing point and boiling point quite readily.

As the thermistor used (ST & C type F23) is the glass stem type 3" long and 5/32" in diameter it will need extra mechanical protection. This can be made by using high temperature thick wall plastic sleeving or tubing and bringing it over the thermistor stem to within about ½" of the bead end. Allow sufficient tubing to cover the connections soldered on to the lead wires. An added refinement is a wire mesh cage around the thermistor tip for added mechanical protection.

Elegant variations

(1) Over temperature alarm.

If in place of, or in series with, the meter a sensitive relay is used then at some preset point an alarm could be sounded when the temperature reached danger point. Alternatively, if the engine was unattended stationary engines switch engine off.

(2) Automatic multipoint recording.

A self sweeping uniselector pulsed, say, for five or ten second readings, could be used to check a large number of points. Here it would be necessary to have a display panel indicating the point being read at any instant. Longer hold periods on the uniselector (perhaps 30 seconds or a minute) would allow an over-temperature relay to operate and close down the engine or operation involved. This is a valuable facility in unattended stationery engines such as diesel generating sets.

Values of Components on Circuit

R1 & R6	4.7 K
R2a	5 K
R2b	ST & C Type F53 Thermistor
R2c	10 K
R2d	220 ohms
R3 & R4	560 ohms
R5	11 ohms
R7	5 K
TR_1 & TR_2	OC72N
M	1mA or better-shunted if necessary

THE THIN WHITE LINE

by P. Lindfield and K. Shankland

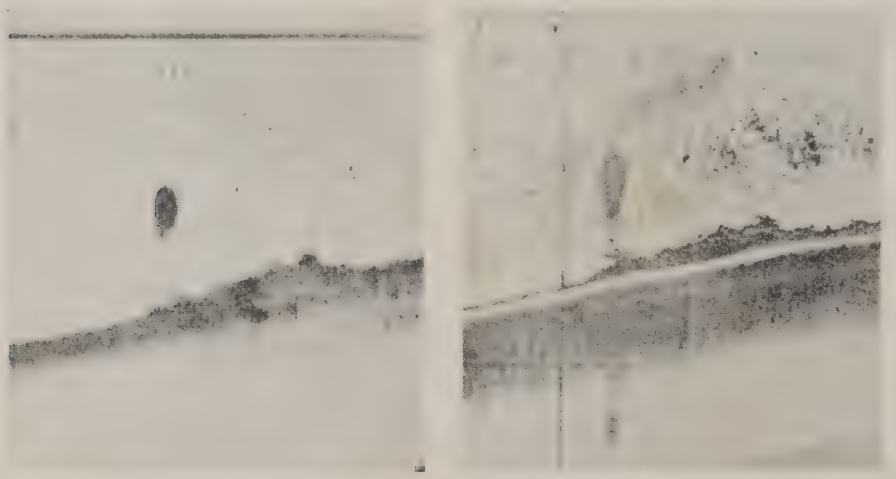
Telecommunications Division,
Pye Ltd., Auckland

The knowledge that sound waves could be transmitted through water had been appreciated for a long time prior to the Second World War, but it took this war, with its attendant technical advances to make use of this fact and to produce the systems known as Sonar and Asdic.

These systems were a means of detecting underwater objects and recording their relative positions. The aftermath of this wartime achievement was the production in peace time of both recorders and fish finders, at a price within the reach of the small boat owners.

Basically there are two types of depth recorder in use today. The depth recorder which indicates, by means of a rotating flashing light or a meter, the depth of water immediately beneath the hull of a service craft and the recording type which displays a visual indication of the sea bed contour on a paper chart which is a permanent record of a vessel passing over the sea bed. Both of these instruments may be used as an aid to navigation. The recording type is commonly used in chart making.

Fish finders are a more sophisticated form of chart recorder embodying the basic principle of Asdic, that is, the location of underwater bodies by reflection of sound waves from these bodies to produce recorded echoes. "White Line" fish finders are even more sophisticated in that they offer the maximum in depth discrimination and are able to indicated fish close to or on the bottom, or individual fish at any depth without confusion of these echoes with the bottom indication.



On the echogram at left it is virtually impossible to distinguish between the fish and the sea-bottom because recordings from the fish overlap with the recordings being received from the sea-bottom.

On the other echogram it is simple enough to make the distinction because the thin black line indicates the sea-bottom. The heavy thickening above it indicates fish close to the bottom. In this case the recordings were being made from cod and haddock.

The frequencies commonly in use in "White Line" fish finders are between 35 and 100 k/s. With the speed of sound through water being approximately 4900 feet per second, dependant upon the temperature and density of the water, it now becomes obvious that a short transmitted pulse of sound will produce echoes from varying distances depending upon the frequency of these pulses. As the amount of returned energy or echo falls off rapidly with the distance from the transmitter to the fish and back again, it is imperative that the maximum transmitted energy should be used. This energy must be contained within the shortest practical pulse time as echoes can not be received whilst transmitting, and it is desirable to locate fish quite close to the vessel and also to discriminate between fish or shoals of fish close together.

Transmitters consisting basically of a pulsed ultrasonic oscillator with power output of 100 watts and upward and a pulse time of 1000th of a second duration are typical. With these transmitters a pulse repetition rate of one pulse per second will give a maximum distance indication of 2450 feet approximately. However, the pulse repetition rate is usually variable so that shorter ranges may be used with more discrimination as more echoes per time interval will be received.

The transmitted pulse is passed from the transmitter output stage via a cable to transducer. The transducer converts electrical energy, from the transmitter, to ultrasonic energy for its passage through the water and is in direct physical contact with the water. The transducer typically comprises a magneto strictive device, in the form of a solenoid whose length contracts and expands in phase with the frequency of the magnetising current. One end of this solenoid is the physical contact with the water, and is mounted in a sealed housing below the hull. The surface area of the transducer is a governing factor in the concentration of power into a relatively narrow beam. The larger the surface area the narrower the beam will be, and within this beam of high energy concentration, fish will be located by the amount of energy reflected from their bodies. During the quiescent state of the transmitter, minute energy reflections from fish impinge upon the transducer surface, which converts the ultrasonic pulse to an electrical impulse which is carried via the same cable to the receiver input. During the transmit cycle the receiver is disabled, but in the quiescent period of the transmitter, the receiver amplifies impulses by

means of a conventional ultrasonic amplifier, so raising the level of the echo sufficient for it to operate the recorder.

The recorder of a "White Line" fish finder is of the mechanical moving chart variety having echoes marked upon it by an electric pen. The paper of the chart is manufactured from a material which produces black marks on the passage of an electrical current through it.

The pen is moved over the surface of the paper (for example: once per second) and at the commencement of its transmit cycle produces a mark coincident with the transmitted impulse as the pen actuates the transmitter. This mark represents the zero datum line and received echo marks, by reference to the datum line, convert time to distance.

Fish are indicated by these marks, and the size and quantity of fish can be determined by the correct interpretation of the marks displayed. Echoes received from the sea bed are indicated by a continuous marking of the chart as the bottom contours change. Concentrations of fish on or near the sea bed tend to merge with the sea bed echo and appear on the chart as part of the bottom contour. To enable discrimination of these fish from the bottom echo "White Line" was added to fish finders.

The "White Line" is literally a white line which appears immediately beneath the first echo received from the top surface of the sea bed on the recording chart. This effect is brought about by the advantages of high power transmitter and the large amount of energy reflected by the surface of the sea bed. Use is made of a very sensitive receiver which "blocks" on receipt of these large impulses, so causing the electrical pen to indicate the sea bed contour and then to produce an area where no recording is made. This sea bed contour will show fish concentrations as a thickening of the line or a separate mass depending on whether the fish are actually at the bottom or close to it.

It can be seen that the white line will be almost the width of the transmitted impulse as the leading edge of the returning pulse actuates the pen then momentarily disables the receiver so producing no record.

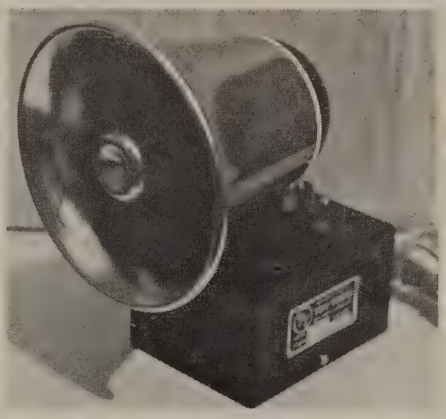
Correct interpretation of the chart is essential if fullest use is to be made of the information contained. Skilled operators can determine the size of individual fish, the size of shoals and also the type of fish in these shoals as echoes received from masses of small fish differ in detail from those received from shoals of large fish. On this basis the operator, who is fishing for say pilchards, can lower nets at the direction of the fish finder and be assured of success. Bottom trawling can also become an exact science taking full advantage of the white line bottom indication and fishing where the chart shows concentrations of fish immediately above the bottom. On better models of fish finders an audible indication of the echo can be obtained, giving the expert operator further information on the nature of fish giving the echo.

Further refinements allow the transducer to be tilted from the vertical plane towards the horizontal and also rotated to give a bearing on fish shoals in any direction and at any depth. Using this method a fully automatic scanning programme can be added which gives a sweep ahead, on both port and starboard quarters, and is adjustable to suit the varying types of vessels in use. This then allows course changes and the lowering of nets to be made after fish have been located, but before the fishing vessel steams over them.

A fish finder can easily pay for itself within one year of installation by increasing catches if the operators place their faith in the finder, and fish where the chart says there will be fish. Bottom trawlers can save damage to nets by watching the bottom contour ahead of the trawl net and note changes indicating unfavourable bottom conditions.

"White Line" recorders came into their own in these circumstances as older recorders could indicate poor sea bed, whereas in fact the alterations of contour could be fish.

TRANSISTORISED BOAT HORN



Many small-boat owners have given thought to installing some kind of horn or other warning device to their craft, but have been reluctant in doing so because of the expensive, and sometimes unreliable nature of some types of mechanical horn now available.

These horns rely upon vibrating contacts and diaphragm and the effect of salt spray on the contact points increases the necessity for constant cleaning and service. The current taken by some horns is in the region of 3 to 6 amps. and this amount of current produces pronounced sparking at the contact points. It is obvious that, unless these points are housed in a hermetically sealed case, this serious sparking could be a contributing factor in setting off an explosion or fire, if sufficient petrol vapour or fumes are present.

The transistor horn is offered as a safe and reliable warning system for small craft and is made up of two parts. The transistors and associated components which do the switching electronically, are housed in a durable anodised aluminium box, which is sealed with epoxy resin before despatch, and a high-efficiency horn-type radiator. The moving coil of the radiator is protected by an anodised aluminium cover.

A 4 watt unit is at present available, but currently under development are two larger versions for bigger craft. These will have naturally, greater range and output. The explosion hazard has been virtually eliminated since switching is done at very low current levels, i.e. typical 1/20 amps and sparking has yet to be observed or measured.

The power consumption is approx. 3/4 amp at 12 volts. It becomes practical to run the unit from dry cells for short periods. The system lends itself to other applications where semi-remote control is an advantage. An adaptor will be developed which will turn the horn function to that of a manually operated siren.

The range of the 4 watt version is at 3/8 mile over still water and approx. 1/4 mile under adverse conditions. Six volt operation is possible, but with reduced output and range. The design of the circuit allows reliable and continuous use over a wide temperature range.

—A release from "Ten-Trans."

ENQUIRY CARD AD. 17

HEATHKIT by DAYSTROM

Heathkit designs marine equipment for the particular needs of marine operators

3 BAND DIRECTION FINDER MR21A

Covers Beacon, Broadcast and Marine Bands. Fully transistorised for low battery drain and reliability. Built in BFO for receiving morse signals. Easy access to battery compartment. Uses locally available batteries. Easily wired and assembled. If required we can do assembly for you at moderate charge.

RUDDER POSITION INDICATOR M1 14

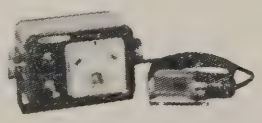
Ideal for the larger boat where visibility can be obscured. Tells instantly exact position of rudder from control panel. Allows full manoeuvreability without moving from the wheel. Operates on either 6v or 12v. Panel mounted. Be smart—install a rudder position indicator now and make it a Heathkit.

TRANSISTORISED TACHOMETER M1 31A

Know your exact speed—Don't guess. A Tachometer is the answer and the Heathkit one is made just for your boat. Handsome brushed, anodised, diecast case, lighted dial, simply installed. Two ranges 0-4000 and 0-8000 RPM. Unaffected by voltage or temperature variations. Also in the Heathkit range, marine R/T, marine electrical ground system.

FUEL VAPOUR DETECTOR M1 14

Approved by fire underwriters as the only safe and accurate system to warn of dangerous fumes. Comparison principle indicates accurately if vapour in boat nears explosive level. Avoid the boating tragedies so often reported in newspapers by safeguarding your life with this vapour detector.



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USE PR AND KNOW WHERE YOU ARE

PR CRYSTALS

Especially suited to marine applications and made to the highest possible standards. Made in America these fine crystals are fully sealed in metal holders. Unconditionally guaranteed. All marine frequencies normally held in stock. Other frequencies readily available as well as sub-standard crystals and complete oscillators. For accuracy and dependability use PR and know where you are.

PR-100 TRANSISTORISED OSCILLATOR

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P.O. BOX 170 LOWER HUTT 83 PRETORIA STREET TELEGRAMS "FRANDS"

a problem solved

TRANSISTOR DC CONVERTER

by Doug Tennent

Colin and Jim were at the boat harbour, preparing their 30ft. launch for the summer. At 10 o'clock Colin turned on the radio to hear the latest news. Several minutes later, both realised all was not well, as no sound came forth from the speaker.

"Battery flat, I suppose," remarked Colin.

"Hard to figure. It turned the motor over early this morning and seemed o.k.," replied Jim.

Fifteen minutes later, Jim, with the radio, arrived at a workshop specialising in the repair and maintenance of marine radiophones. Jim, prepared for the worst, gave the workshop proprietor, Peter, an account of the trouble. Peter quickly noted that the set had started out in life as a war-time transmitter-receiver and had seen a lot of modification since then.

It did not take long to find the trouble. The vibrator was "out."

"Thank goodness for that," said Jim, who did not realise that the problem was not as simple as first appeared.

After searching for a replacement and finding none Peter telephoned several likely suppliers in the city. No stocks of this synchronous type were to be found anywhere and he decided a new look at the problem was necessary.

Greeted with the bad news, Jim queried, "What about these transistor units I've seen advertised? Won't they do the same job?"

"They'll do it nicely," replied Peter, "but first I want to try out an idea." He reasoned that by retaining the main transformer and replacing the vibrator with a pair of power transistors arranged as a cross-coupled multivibrator, he could save the cost of a complete unit. He mounted the transistors on a small piece of aluminium, wired them into the circuit, and turned on. The system worked, but on checking a few currents and voltages, it was discovered that the conversion efficiency was only around 50 per cent.—even worse than that achieved by the vibrator.

Better efficiency and reliability could be gained by the use of a properly designed and built transistor unit, he reasoned. After a brief calculation, he decided a 50 watt type would do the job.

Taking out the old supply did not take long and soon the new unit was in place and wired up. Peter carefully observed the manufacturer's instructions and mounted the supply on the back part of the chassis where a mild air flow would help in keeping it cool. The new unit occupied less than half the space taken by the cumbersome vibrator supply.

"I've heard that these transistor jobs are very efficient. Is it true?" Peter questioned Jim.

"Too right. This little beauty has an efficiency of about 85 per cent. This means that for the same transmitter output, less current is drawn from the battery." They quickly worked out that Colin would have a saving of 1 to 1½ amps.

"Seems pretty good to me and the unit is a lot smaller than the old one."

"Lighter, too," commented Peter. "You see Jim, the transistor supply converts the energy from the battery at a higher frequency than the vibrator, so less iron is needed in the transformer. Less iron—less weight. The transistors do the switching electronically. Turn the set on and see what happens." Several seconds later, Jim heard the familiar sound of his radio coming "alive." Peter checked that the voltages were as specified and spun the dial across the band. Several stations were heard.

"I can't hear any buzzing noise. Are you sure everything is right?" asked Jim.

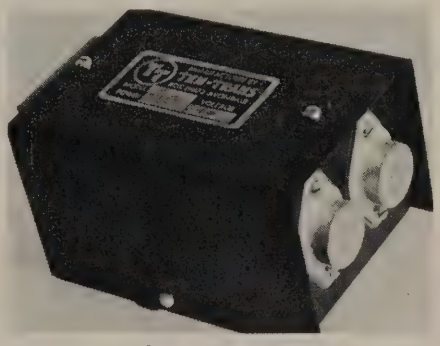
"Don't worry, old buddy. This supply operates around 600 cycles or so. You can hear a faint tone if you listen carefully, but you'll agree, she's very quiet."

"You're right. I can't hear any hashy sound coming from the speaker either."

"Sometimes these units do produce a little hash, but with a little intelligent care taken with single point earthing, it clears up without any trouble. Much less work than de-bugging a wild vibrator supply. Another point, Jim, is that there are no mechanical parts to wear so you can expect many years of service from this supply. In fact, it will outlast quite a few changes of valves in your set."

"Colin will be happy. We've always regarded the radio as our 'insurance policy.'

"Knowing the chances of failure are much less will please him no end," said Jim.



Typical 40 Watt Converter

Peter quickly and carefully peaked up all the R.F. circuits in the receiver section then set to and checked out the transmitter. A report from Auckland Radio convinced him that the signal was up to strength and "clean."

"We've often had reports from friends of a buzz on the speech," said Jim, who was, by this time, feeling very happy with his "new" set.

"No troubles like that now, Jim. The transistor supply can produce a little hash, but because of the higher frequency involved, filtering is that much easier and any noise is eliminated. Here, let me show you," and Peter connected the input leads from his oscilloscope across the 250 volt line. He set the 'scope' for A.C. input, turned up the vertical gain, and pointed out the clean line running across the face of the tube. "No ripple there, Jim." His friend was very pleased.

"Aren't those small transistors fragile, Peter?" he questioned. "Not really, Jim," replied Peter. "These fellows can stand up to more knocks and vibration than you realise. The whole unit is rugged. I dare say you could damage it with a hammer, but who's going to do that?"

Peter then tidied up several wires, pronounced the job done, and re-assembled the chassis back into the case. Jim was more than satisfied, and expressed surprise with the low cost of conversion.

"You won't be replacing the converter for many years, Jim, so the little extra on the cost of a vibrator replacement will be more than offset by the saving in maintenance costs."

Jim again thanked Peter for a job well done, and asked if he had a few minutes to explain a little more about transistor supplies so he could pass it on to John. "Certainly," replied Peter.

"Now let's see. In the vibrator supply, the switching necessary to 'chop-up' the D.C. flowing from the battery is done by vibrator reeds and power is necessary to get them vibrating. This power doesn't produce any output power, so it's wasted. Efficiency falls to approximately 60 per cent. I've already mentioned that with the transistor pack you can expect a battery saving of 1 to 1½ amps. This unit is physically smaller and more reliable. Maintenance of your set will now only involve replacement of valves and small components.

"Although the weight saving will not affect you in some circumstances, it is quite important.

"Did you know that supplies of this type are not confined to marine radio-telephone use? Amateur radio equipment, portable public address systems, taxi radios, and in fact, everything that has to draw its power from storage batteries, could profitably benefit from their use. As long as a couple of simple precautions are taken and the units placed well away from heat-producing components such as large valves and transformers, then a long and satisfactory life can be expected. With newer developments in silicon transistors, this heat worry will be a thing of the past, as these devices can operate up to 200° centigrade. Any more questions?"

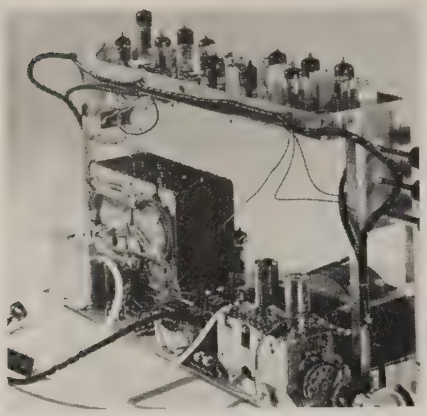
"Yes. What range of outputs can you get with these units?"

"Well, really there is no limit. Power transistors are now available that will switch kilowatts."

"I have heard the word 'inverter.' Is this the same as 'converter'?"

"No, Jim. An inverter is a similar device for transforming a low D.C. voltage to a higher A.C. value. By adding a rectifier and filter to an inverter, a D.C. to D.C. converter results. Most inverters are designed to operate around 50 cycles so that equipment which normally runs off the mains can operate electric razors, small radios, heaters, for instance."

"Well, Peter, thanks for your time. I must be away now, or Colin will think I'm shirking. Thanks again."



Laboratory Report

Philips New Printed Circuit Tv. Kitset

The requirements nowadays applied to kitset equipment can be readily summarised in the "three easies"—easy to assemble, easy to line-up and easy to service. Built in to these requirements are the important issues of good design and reliability.

These, then, we will apply to the kitset under consideration—the Philips SD 23 CX television kitset. The kit comes complete with all components except the picture tube and cabinet—a few minor omissions excepted. The bulk of components are to be mounted on printed circuits. Chassis construction is such that controls at the right hand side of the cabinet should be allowed for. Circuitry is for a 19" or 23" picture tube and appreciable modification would be needed for the smaller tubes currently becoming available. Remote control modifications to the circuit are explained in the manual.

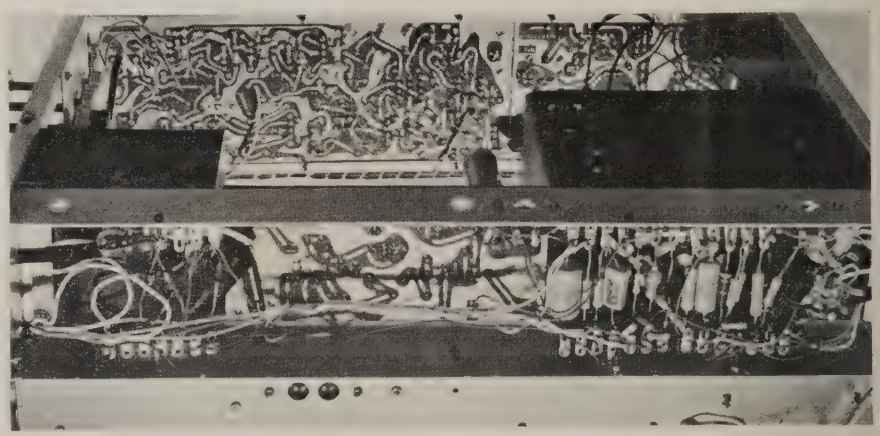
CONSTRUCTION

The general open box construction can be seen from the first illustration. The principal vision and sound channel components are mounted on two printed circuit boards on the top of the chassis with the vertical oscillator and output stage mounted on a smaller printed circuit board adjacent to "line box" at the bottom of the chassis. This method of construction means that some 24, or so connections (or interconnections) are needed from top to bottom and present one of the major disadvantages—really neat construction is difficult to achieve.

Wiring up the printed circuit panels was a joy as all components supplied (resistors and capacitors) came attached to labelled cardboard strips that made identification foolproof particularly with each circuit board having location references. Only on one case did a supplied component not fit—a coupling capacitor to be mounted vertically required one lead extended to fit into panel solder holes. The care taken in the printed circuit panel design strangely falls short when it comes to mounting holes—why it should be necessary to drill mounting holes in p.c. panels is not understood when their location on mounting brackets is exactly known. Why, too, is one panel drilled and the other two not? While some hardware was supplied this stopped short at self tapping screws needed to mount the line box, yet these are mentioned in the text. Similarly the only coaxial cable (or shielded cable) supplied was for the tuner-IF channel connection but three other shielded leads are needed.

The deficiency in some hardware, the need for drilling to be done and the lack of shielded cable means that a country constructor would not be able to complete the job without outside purchases.

The printed circuit panels do not extend to horizontal output components (external to the line box) and the boost voltage chain, and it is in these departments as well as the power supply and filtering, that the layout becomes messy and care is needed. The second illustration shows the under chassis below the line box. This reviewer feels that a fourth, small, printed circuit panel could have been supplied to accommodate the components "loose" mounted at the moment. Some components in the input circuit of the horizontal output valve are mounted "up in the air", surely to be depreciated when no intermediate tie points are provided and valve pins are the only end connections. Similarly resistors mounted direct on to the frame transformer lugs could have better been accommodated on a printed circuit panel.

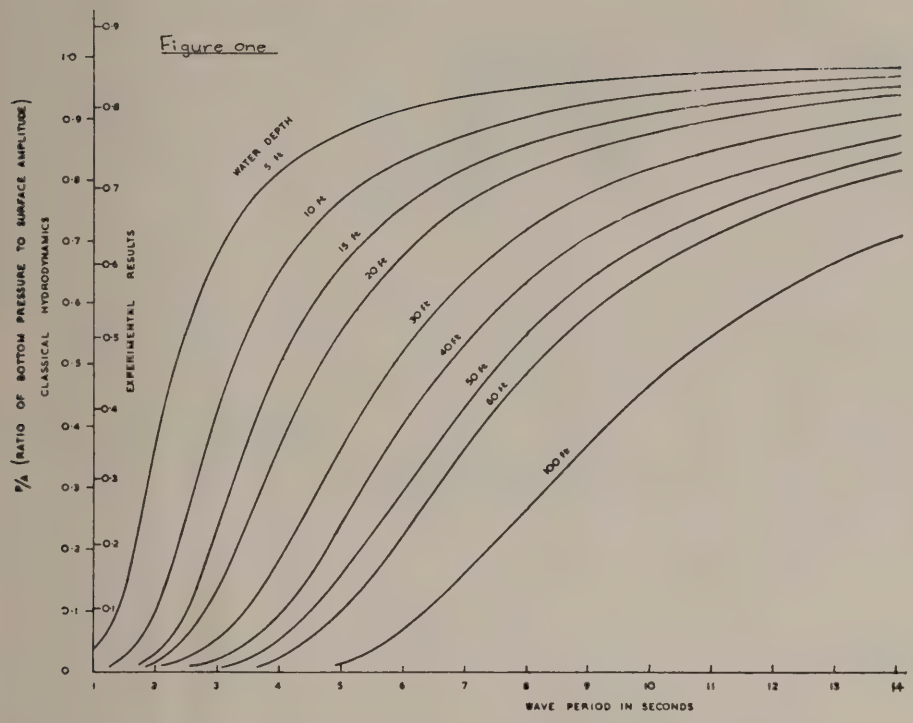


LINING UP

The transformers and coils supplied are said to be pre-tuned and certainly Philips are to be congratulated on successfully designing a kit that does not need instrument lining up. Simple screwdriver trimming up procedure is detailed and this should suffice for all but bad fringe areas. A good picture was obtained at first trial merely by adjusting fine tune.

However, it is felt that serious alignment may be another matter. Certainly this is implied in the manual section dealing with video I.F. Frequencies accurate to .05 Mc/s are not within the accuracy of signal generators to be found

Continued on page 33



Transducer — Bellow Wave, Tide and Water Level Recorder

by J. K. Gladwell, A.M.I.E.E., M.N.Z.I.E., with P. E. Watts

This article describes a unit developed by the N.Z. Ministry of Works to provide information useful in the design of marine structures, harbour development and flood control.

Simply, the unit consists of a device which measures changes in water pressure at the sea bed and is connected electrically to a recording device on land.

Variations in water pressure are recorded, using one of the following; the piezo-electric sensing device, pneumatic pressure sensor, or displacement transducer connected to pressure sensitive bellows. The piezo-electric wave recorder is rather complicated and utilises a quartz pile in the sea to produce a potential with varying pressure. The pneumatic pressure recorder has a sensing device which is basically an inflated rubber bulb or tube connected by a hose to some form of recorder on the shore. Both of these systems have considerable drawbacks from the viewpoints of complexity and durability.

Transducer-Bellows Recorder

Change in pressure caused by rise and fall of tide provides a proportional change in pressure at the sea bed. Thus tide measurements may be made in any reasonable depth of water. A passing wave presents a different problem, since the static depth of water actually 'damps' the pressure change at the sea bed. Figure one illustrates relations between pressure fluctuations on the sea bed, surface wave height, wave period and depth of water. For optimum results, wave height and period measurements are made in shallow water of no more than five feet.

The sensing unit is a linear displacement transducer actuated by a push-rod. It provides a change of resistance proportional to the axial displacement of the rod. This push-rod is connected through a water-tight fitting to a Hydroflex metal bellows. Both transducer and bellows are mounted in a sturdy galvanised iron frame. Ordinary three-core T.R.S. or P.V.C. cable connects the transducer to the shore.

An amplifier bridge unit, D.C. mA recorder, and battery comprise the shore unit. Details of the transistorised bridge are shown in Figure two. It is of standard circuitry and many commercial variations are available. An alternative amplifier bridge circuit with sensitivity adjustment is shown in Figure three. The recorder is of the centre zero type with a range of ± 0.5 mA. Tide wave measurement accuracies within one inch are possible.

Left: Figure two illustrates the transistorised bridge.

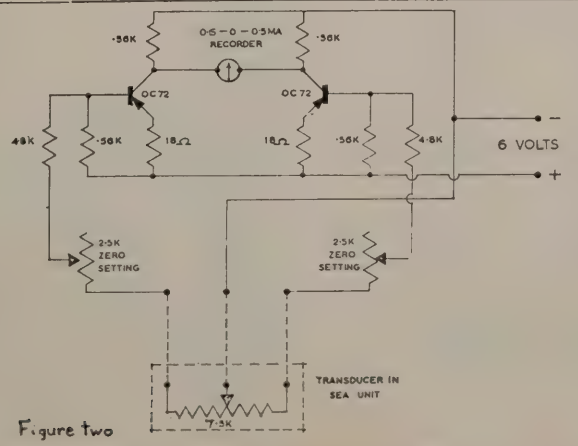


Figure two

Right: Figure three shows an alternative amplifier bridge circuit with sensitivity adjustment.

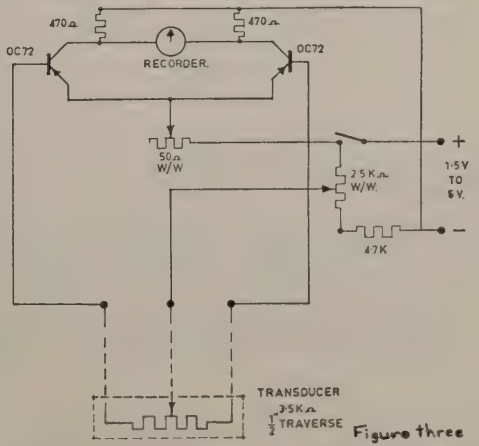


Figure three

ENQUIRY CARD AD. 18

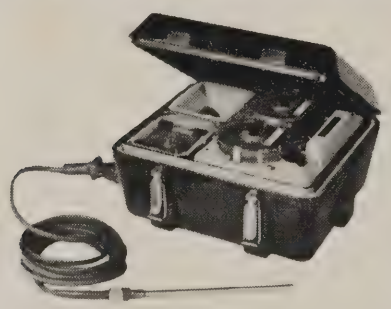
d-mac Ltd.

- *data systems and electronics*
- *trace analysis equipment*
- *graph plottings*

The big news in the British Electronics industry this year was the acquisition of "d-mac Ltd" by the Thompson Organisation Ltd. "d-mac Ltd" was originally owned jointly by Dobbie McInnes Ltd. of Glasgow and Don Brothers, Buist and Co. Ltd. of Forfar.

Introducing a multi-channel

LIMPET LOGGER



A small digital recording station for field use. Records all metrological data, can be left outside in weather for up to 12 months. Magnetic tape recording on 1-10 channels.

PENCIL FOLLOWER

Automatic map-making machines

A pencil follower reduces the complex processes and mechanisms of earlier analysis machines to the simplest. The analysis operation is a completely natural one for any person without special training. The pencil follower provides punch card information from chart records, film records, maps and architectural drawings.

d-mac also represent SEFRAM of Paris, the leading French electronic house.

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ENQUIRY CARD AD. 19

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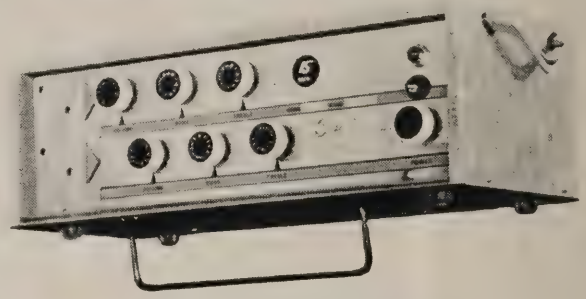


Model 5303 with Tilt Bar Extended

CONCORD PUBLIC ADDRESS AMPLIFIER

Adaptable to all systems this 15 watt R.M.S. Concord P.A. amplifier has power and frequency response well above usual P.A. limits. Many extras are built-in "standards" with this Concord amplifier that meets the rigid standards of reliability, purity of sound and stability of all models in the Concord range.

Also available with 35 watt output.

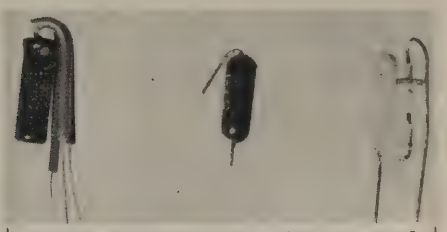
concord
ELECTRONICS LTD
P.O. BOX 36001., NORTHCOTE, AUCKLAND, PH.285-825

ENQUIRY CARD AD. 20

SERVICEMAN'S COLUMN

Conducted by J. Whitley Stokes

It is interesting to speculate to what extent lead-mounted transistor and diode failure is due, not to any inherent weakness in the component itself but to the receiver manufacturer's disregard of the semiconductor manufacturer's recommendations.



Left: good. Centre: bad. Right: suggested. Centre unit is shown exactly as removed from board.

To illustrate the point, one local manufacturer of transistor receivers, in some models, adopts an unconventional procedure of mounting transistors upside down on the P.C. board. That is to say instead of the transistor's leads being threaded into the mounting holes and then pulled through so that the bottom of the transistor is hard up against the board, the leads are left full length and after being covered with sleeving are bent over 180° and dressed against the body of the transistor. The reason for using this method of mounting is to ensure that consequent soldering operations can not then cause appreciable heat to be conducted into the interior of the transistor. With the usual method of mounting particularly where transistors are mounted hard down on the board it is obviously impossible to use any form of heat sink with the inevitable result that some degree of heating of the transistor elements will occur during soldering. With the upside down method of mounting the extra length of the leads forms a natural and very effective heat sink.

Although in the above remarks, the term transistor has been used in place of the more cumbersome word semiconductor, what has been said can be taken to include diodes as well. Even more so in fact as in the case of the particular models referred to although the manufacturer has made a praiseworthy and successful attempt to overcome heating problems during soldering, for some unaccountable reason the procedure has not been extended to include the detector diode. Diode failures are rather common in these models — need I say more?

Probably the first thing one hears about transistors is their susceptibility to heat and the need to employ some form of heat sink when soldering. Dire warnings have been issued as to the ill effects of soldering too close to the body of the transistor, this being the case it has long seemed to me that it is due more to good luck than good management that there are not more semiconductor failures in commercially built equipment.

In order to satisfy myself that no special precautions are taken by receiver manufacturers during ordinary production runs, I recently took advantage of a long-standing invitation to visit a local factory. There I saw rows of cheerful maidens (and some matrons) wielding large size soldering irons with gay abandon and obviously without a thought for any ill effects on the poor old transistor. It was a case of speed being of the essence, of course, a larger iron allowing a connection to be soldered more quickly.

A couple of years ago Mullard Ltd. went to the trouble of publishing a leaflet for the benefit of service engineers, entitled, "What not to do to a Transistor." It was in the form of some humorous illustrations with appropriate captions. Perhaps they might have addressed it to receiver manufacturers too.

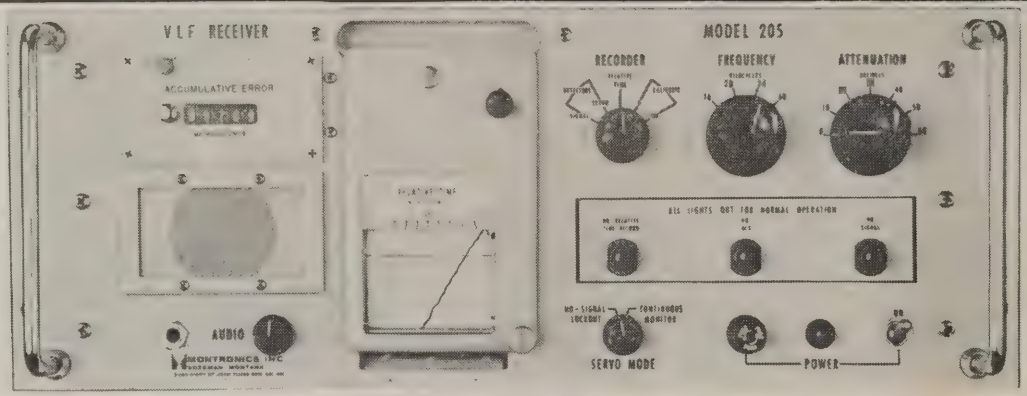
As pointed out in the same leaflet, heat from a soldering iron can damage other components too. A recent case with a new Japanese transistor radio brought this point home quite forcibly.

The set in question exhibited the following symptoms — weak reception of local stations accompanied by whistles suggesting I.F. oscillation or something like it. It was found that when an I.F. signal from the sig-gen. was fed into the base of the first I.F. transistor the gain and response were normal. When the test signal was transferred to the base of the mixer transistor there was a considerable reduction in output instead of the expected increase. This immediately localised the defective stage, but a check of voltages here disclosed no discrepancy. The transistor itself would have been suspected but for the fact that adjustment of the slug of the first I.F. transformer had no effect on response. This seemed to indicate a defective transformer but although such could be the cause of low gain it didn't seem likely to be the cause of both low gain and I.F. oscillation. As an experiment a 100 pF mica capacitor was bridged from the mixer transistor collector to earth and a definite increase in output was noted. The process was continued using progressively larger capacitors until a value of 560 pF was reached, each step resulting in increased output. Now the picture became clear, the fixed tuning capacitor across the primary coil was open circuited. The next step was to locate the faulty component and this turned out to be more difficult than might be imagined, there was just no sign of a condenser of this value anywhere adjacent to the I.F. transformer. Finally it was located underneath the board on the printed wiring side and some distance from the I.F.T. It turned out to be a 600 pF 100V polystyrene and after carefully snipping it out I checked it on the bridge just to be sure and found it open circuited. Just out of curiosity I took a close look at it and noticed a small depression with raised edges on the surface, caused quite obviously by contact with a hot soldering iron bit. Apparently the little accident had gone unnoticed at the factory and in any case presumably hadn't caused immediate trouble as the set must have got through final checking

Continued on page 33

ENQUIRY CARD AD. 21

focus on our agencies



MONTRONICS MODEL 205 V.L.F. RECEIVER

Demonstrations of this V.L.F. receiver are now being conducted at our Auckland Service Centre.

SALIENT Features :

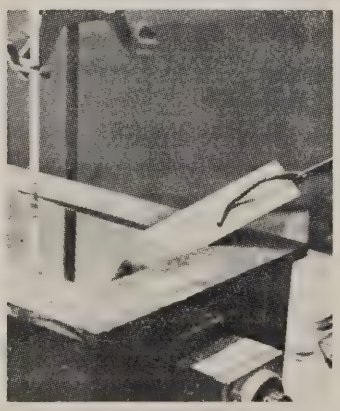
Extreme Sensitivity : 0.05 micro volt at —20 dB S/N. and 50% duty cycle.

Servo Bandwidth : 1 x 10^{-7} of received frequency.

Readout : Relative time — 100μs

Accumulative error — 9999.9μs

We would like to demonstrate how frequency difference is determined when using the model 205, with your counter, (Crystal must be better than 1 x 10^{7}) against the world standards.



Mica Corporation. This is a dip solder test being performed on a test circuit made from Micaply glass/epoxy laminate. We dip sample circuits for 20 seconds at 260°C because the MIL-Spec' says so. Then we leave them in the solder for an additional 40 seconds because we say so.

Is reliability that important? It must be — how else could a highly specialized, single product line company such as ours compete so successfully on an international scale?

There's a grade of Micaply to meet your requirements. And we can deliver that specific grade when and where you need it from strategically located warehouses (yes, anywhere in the free world).
The proof is in performance. Try us.

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KEITHLEY INSTRUMENTS INC. (U.S.A.)
MIKROS INCORPORATED (U.S.A.)
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SERVICE AND CALIBRATION FACILITIES AVAILABLE

Tv. Kitset

Continued from page 28

in home experimenter's workshops. Similarly VTVM's are not as common as that. In any case, it appears that such alignment would not be necessary.

For optimum operation the boost voltage should be set to 960 volts, but no idea is given of the settings to be given to other adjustable controls, some of which affect the boost voltage.

Linearity, height and vertical oscillator frequency preset controls on the "vertical" p.c. panel are rather crowded and difficult to adjust as these controls shade each other making access difficult.

SERVICE AND CIRCUIT INFORMATION

It is here that we are uncertain as to the exact intent of the manufacturers; is the kitset intended for all or only for the more experienced? This determines the extent of technical information provided both to explain the circuit and to enable servicing to be carried out. While D.C. voltages are given on the circuit diagram and C.R.O. traces at vital points shown it would be of considerable assistance to the less experienced if a logical servicing chart had been given in tabular form so that a faulty p.c. panel could first be located and then, more exactly the valve area involved in the fault. By such means servicing with, say, a 20,000 ohms multimeter would be feasible for all but difficult alignment faults.

CONCLUSION

The pre-tuning of coils etc. giving "first on" pictures must be weighed against the hypothetical difficulties arising from service aspects and in balance, printed circuit reliability should give little servicing trouble. The complexity of the circuit, in some sections, may be a barrier to rapid servicing by some constructors and the elegance of some circuitry will be lost on quite a few used to TV receivers having four or five fewer valves.

The construction proper could have been made considerably neater by "looming" connecting wires from one section to another — a large dimensioned diagram would be adequate from which constructors could form up a loom. The set illustrated used "Spirobond" loom lace to give a neat appearance. With a little more thought to the hardware and fixing problems this set could have been constructed in about 10 hours against the 18 hours taken — perhaps not on important point in a set that works so well from the first, but something that any future kitset maker should take care of.

In summary; a kitset such as this with a good picture "first go" can only be recommended.

C.W.S.

Servicemen's Column

Continued from page 31

and alignment before the capacitor developed a fault.

Another oft repeated warning concerns the possibility of damaging transistors by inadvertently shorting together any transistor elements when working on a receiver with the battery connected. In this connection I think transistors have proved to be more robust than their manufacturers believe them to be. One thing I do know for certain — it is a great deal easier to blow an entire set of battery valves by the slip of a test-prod than it is to damage a single transistor by the same slip.

A personal experience can be quoted to illustrate the point. A locally assembled transistor radio belonging to someone I know had developed an intermittent failure to start up when first switched on. Actually the fault had been present since the set was new but as it had not been too annoying in the initial stages the owner had put up with it. I should explain that he was not a customer but someone whom I visited and it was on one such occasion that I was asked for advice. As it happened the set misbehaved when I was present and although having no equipment on hand I was able to diagnose the fact that the mixer stage was not oscillating. Acting on the assumption that the mixer transistor was at fault and would need replacing anyhow I simply pushed the point of a pocket screwdriver in between its leads, whereupon the set "came good". I explained what I had done to the owner and suggested that as it might be some time before I saw him again, he could follow the above procedure himself if the set played up before then. That was three years ago and occasionally the same fault still shows up, perhaps only once or twice a week, and when it does the owner simply pokes a pocket knife blade into the appropriate spot and away it goes again! Partly because the fault has become less frequent with the passage of time, partly because the owner hasn't actually asked me to fix it and partly because I have become interested to see just how long the state of affairs will continue I have never offered to put things right. One fact stands out though, the mixer transistor has survived the rough treatment, in fact even seems to have improved as a result of it. Of course I have never known for certain whether it actually was the transistor which caused the fault as it could have been some other component in the affected stage but I suppose time will tell.

MARINE RADAR

Continued from page 17.

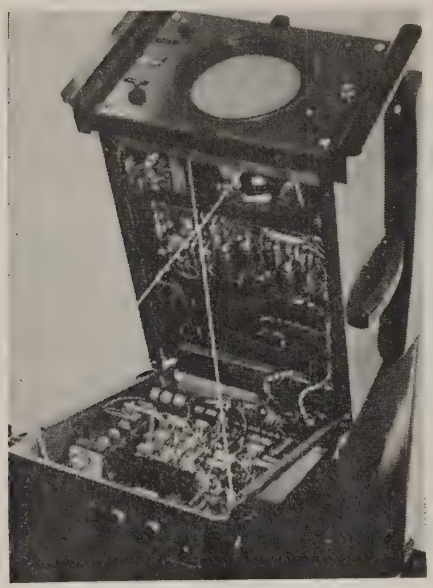
located on the top panel, with the less frequently used controls concealed from immediate view. There are only five main operational controls, which simplifies operation and is a feature of particular value on early acquaintance with the set.

Transmitter/Receiver Unit. This unit contains the RF transmitter unit, transistorised preamplifier and receiver, together with the necessary power supplies. Servicing is facilitated by a meter and switch which gives an indication of the crystal current, tuning, and input voltage, and also monitors the magnetron current thus providing a guide to output power.

Motor Alternator. The equipment is powered by a motor alternator rated at 120 watts output. It is suitable for 24, 32, 110 and 220V DC input. AC inputs are catered for by providing a suitable transformer/rectifier unit.

Efficient maintenance is an important ingredient in the satisfactory service life of radar installations. Potential users should ensure that service facilities are available.

New Products



ADVANCE IN RELIABILITY OF MARINE RADAR

The installation of high performance radar in ships of all sizes has become a practical possibility with the introduction of transistorised units. The first of these to be announced, the Decca 202, has already been installed in ships all over the world, nearly 2000 having been ordered. Its small size, low power consumption, low cost and the fact that it is equally useful in confined waters and in the open sea make it eminently suitable for coasters, work-boats, tugs, fishing vessels, launches and yachts as well as being an ideal second radar for ocean-going ships irrespective of size or function.

The illustration shows the Decca 202 marine radar receiver open to illustrate the compact design of circuitry.

ENQUIRY 218

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COAXIAL WAVEMETER

A new coaxial microwave frequency meter from Hewlett-Packard covers the frequency range from 3.7 to 12.4 GHz with no spurious responses. Key to accomplishment of spurious-free response across nearly two octaves is design of the tuned cavity for the quarter-wave mode, with concurrent damping of three-quarter-wave modes.

The new Hewlett-Packard Model 537A Coaxial Frequency Meter has a 75-inch direct-reading scale, with scale calibrations accurate to ± 0.1%, in increments of 10 MHz. Worst-case overall accuracy is ± 0.17%, allowing for scale errors, humidity variations from 0 to 100% temperature ranging from 12 to 33° C, and for backlash. The instrument provides at least 1 db response dip at resonance, and has Q in excess of 1000. It has a height of 5⅞ in. and has a diameter of 3½ in.

ENQUIRY 225

SILICON PLANAR EPITAXIAL PNP TRANSISTORS

A new series of medium power silicon planar transistors, comprising the 2N3660, 2N3661, ST.8190 and ST.8191 has been announced by Transitron. These transistors are lower cost, higher performance versions of the earlier 2N1084. The ST.8190 and ST.8191 are manufactured using the epitaxial technique, which gives them lower saturation voltages and lower output capacitances than the general purpose 2N3660 and 2N3661.

As a result of mounting each transistor in a solid-based JEDEC TO-5 package, 5 watts may be dissipated at 100°C case temperature. A stud — or flange — mounted version can be supplied where it is necessary to utilise the full power dissipation.

ENQUIRY 162

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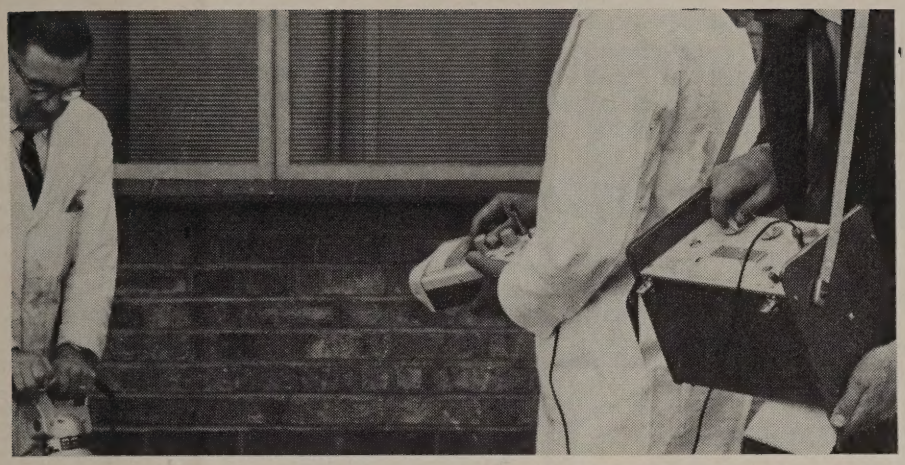
DESOLDERING INSTRUMENT

The Austen Soldermaster desoldering instrument, manufactured in Britain and now available in N.Z., is able to remove multi-pin components from printed circuits in seconds, without damage to adjacent parts. Tracks are not lifted from printed circuit boards and costly assemblies and components can be salvaged. This easily manoeuvred tool is simply held in the hand.

ENQUIRY 221



EQUIPMENT OVERCOMES PROBLEMS IN ANALYSING IMPACT NOISE

A British firm has overcome the problems represented in dealing with and analysing impulsive or impact sounds as heard by the ear. The normal sound level meter does not truly respond as the ear would to the ticking of a clock, the tapping of a typewriter or the peal of a bell. A camera and oscilloscope can be used to study impact noise but the data obtained cannot easily or quickly be compared. Also this equipment is not truly portable.

Now this impact noise analyser has been marketed. This portable battery-operated instrument resolves the limitations of the sound level meter by measuring the peak amplitude and analysing the characteristics of impact noise on the spot.

Used, as shown here, in conjunction with a sound level meter the Type 1412 gives a direct reading of the peak intensity of the noise and information from which the duration and waveform of a single impact can be estimated. The instrument is supplied in a portable metal cabinet with detachable cover and neck strap. Weight including batteries is 8½ lb.

ENQUIRY 229

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SILICON RECTIFIER STACKS

A greatly extended programme of silicon rectifier stacks constructed from disc cells is now available. A particularly noteworthy feature is that these stacks are now available for all the usual voltage classes (cyclical peak inverse voltage 300, 600 and 900 V).

Various designs of cooling fins are available, each disc cell being provided with one, two or four fins according to the current rating, e.g., in three-phase bridge connection, ratings of 100, 150 and 240 A are possible with natural cooling and 250, 350 and 500 A with forced air cooling.

The stacks can be supplied for all the usual connections and any number of units can be connected together. Hence, the new programme covers an extremely wide power range.

ENQUIRY 196

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ELECTROLYSIS PROBLEMS SOLVED

Electrolysis affecting pipe work of the sprinkler system at the new £250,000 Waitakere television transmitter posed an unusual problem. The situation was created by the electronic and electrical equipment in the specially constructed link room. When the beam signal from the microwave link was received, it was found that electrolysis would affect the pipe work of the sprinkler system.

To overcome this, a simple but effective method of minimising corrosive action was devised by creating a "sacrificial unit", consisting of a ¾" thick zinc ring inserted in the pipe line outside the link room. The "sacrificial unit" attracts the electrolysis and so preserves the pipe work. As soon as the unit deteriorates it is replaced. The 12,000 sq. ft. transmitter building has been constructed of wood instead of metal to keep electronic problems at bay and it houses transmitting gear, control room, offices, work shop and facilities for staff remaining overnight.

ENQUIRY 228

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VAPOUR-COOLED KLYSTRONS IN LINK EQUIPMENT

An order for English Electric vapour-cooled reflex klystrons has been placed for use in 7.0 Gc/s microwave link equipment.

This equipment, which is capable of transmission of 625 line television signals or 300 telephone channels, has previously used conventional klystrons. It is being supplied to meet the British Post Office requirements for this class of equipment as well as a number of overseas administrations.

A two-way, three hop system has recently been installed between Plymouth and Goonhilly to extend the existing Post Office network from London to Goonhilly for experimental use with the "Earlybird" satellite.

The frequency of reflex klystrons is temperature dependent. Very stable frequency sources of microwave power are possible, however, with the use of vapour cooling as virtually constant temperatures may be achieved independent of ambient fluctuations. This system obviates the need for costly and complicated A.F.C. and maintains the frequency within the limits laid down by C.C.I.R. Vapour cooling, as applied to klystrons, is relatively new and E.E.E. have carried out extensive research and development on this application.

ENQUIRY 178

UNIT PREVENTS DAMAGE TO HF RECEIVERS

A British unit which protects high frequency receivers operated adjacent to high-power transmitters is said to be cheaper and more effective than screening shields or cages. An HF receiver pre-selection and protection unit, it is installed between the aerial and the receiver's input circuits. The manufacturers say that it allows successful operation of the receiver and prevents physical and electrical damage. The unit is said to enable a high degree of pre-selection to be achieved, thus reducing interference from adjacent channels, and also reducing cross modulation effects. For an unwanted signal five per cent off tune, an attenuation greater than 95dB is obtained, without reduction of overall gain and with only minor effect on sensitivity.

ENQUIRY 182

* * *

TRANSISTORISED DIRECTION FINDER

A fully transistorised portable marine direction finder is being marketed by Coastal Radio (N.Z.) Ltd. This Raytheon radio direction finder features three bands Beacon broadcast marine "2182 Kc/s". It has sense antenna and weight of 13½ lb.

ENQUIRY 233

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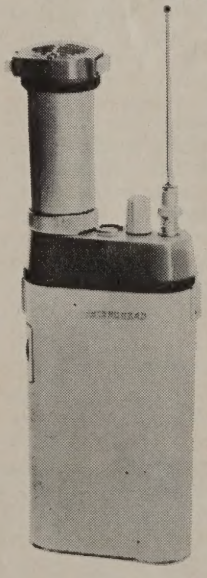
HARBOUR SURVEILLANCE SYSTEM



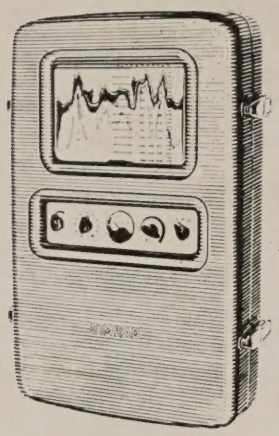
Tauranga Harbour Board has awarded A.W.A. a contract for the supply and installation of radar and VHF/FM communication equipment. Base station transmitting and receiving equipment, installed at the Board's Mt. Drury signal station, is remotely controlled over Post Office lines from the pilots' duty office and from the wharf watch office.

Marconi marine mobile transceivers are installed in the pilot vessel, tug and harbour work-boat. Additionally, Telefunken pocket-portable transceivers are supplied for pilots to ensure effective control of pilotage and berthing operations. The board's pilot vessel is also equipped with Kelvin Hughes type 17 transistorised radar.

The entire system, which is designed for future expansion, provides a reliable means of communication on international frequencies for harbour control.

The photograph shows one of the Telefunken transceivers. In 80, 100 and 160 Mc versions, weight 3½ lb., the Teleport VI has provision for up to four simplex or semi-duplex channels. Transmitter output is .5 watt.

ENQUIRY 226



ECHO SOUNDER

The Simrad Skipper which is an efficient, easy to operate echo sounder for small and medium sized vessels has a maximum depth range of 320 fathoms, with white line features down to 150-200 fathoms. Several models within the Skipper range have different ranges and transducer sizes. Easy servicing is assured by the plug-in system of the recorder and electronic unit.

A voltmeter and regulator to control the working voltage are supplied as standard equipment. Power consumption is approximately 80 watts. Approximate outside dimensions are: cabinet height 25 in., width 15½ in., depth 6 in.; transducer length 17¾ in, width 8 in., height 2½ in. Active face of the transducer is about 4 x 4 in. or 4 x 6 in.

ENQUIRY 241

* * *

UNDERWATER TELEPHONE SYSTEM

Underwater speech communication by means of a frequency modulated ultrasonic carrier is provided by the Hydrovox type 375, stocked by Coastal Radio (N.Z.) Ltd. No trailing cables are necessary and direct conversation is possible between free divers or divers and surface vessel. The fully transistorised equipment is powered by internal dry batteries. Communication may be in any direction to ranges of up to 1,000 yards, in suitable conditions.

The diver's unit is contained in a tough plastic cylinder with hemispherical ends measuring 12½" long x 3½" diameter, and weight 3½ lb. It is intended for mounting alongside the diver's oxygen cylinder with minimum inconvenience or risk of obstruction to other gear when operating under water. The transducer is carried in a positively buoyant capsule attached by a short length of flexible cable. It will thus float clear of the diver's head whatever his position, giving an all round field of transmission. Control switching is by means of a simple, robust, hand operated three position switch which may be clipped to any convenient point on the harness. Switch positions are: 1 off, 2 receive, and 3 transmit. The headset consists of two small bone conduction units, the transmitter positioned on the diver's throat and the receiver above and behind his ear. All items of the diver's set are hermetically sealed and designed to operate at depths down to 200 feet.

The surface unit has the same electronics as the diver's set, plus an amplifier and enclosed loudspeaker mounted in a robust splash proof case for shipboard use. The transducer has negative buoyancy and is supported about 2 feet below the surface, from a small buoy positioned alongside the vessel. The microphone and loudspeaker are mounted within the case which measures overall 4" x 6" x 8½".

ENQUIRY 220

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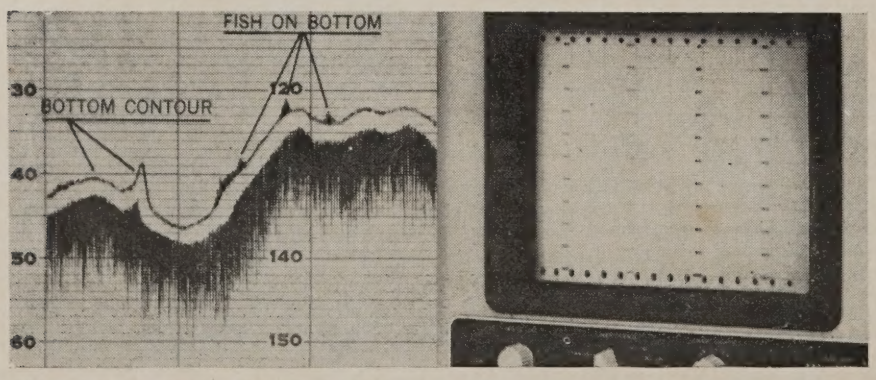
MARINE RADIO TELEPHONE

Entry into the marine radio telephone field with their Mariner I set, has been announced by A. M. Tait Limited, long experienced in the mobile radio telephone field. This set will be fully reviewed, with lab testing comments, in our November issue. In general outline the Mariner is a full 50 watts input set, entirely transistorised (apart from two transmitter tubes), engineered electrically and mechanically to a high standard and introducing some quite original features. The Mariner will be distributed on a national basis.

ENQUIRY 231



Precise tracing of the ocean floor is separated from residual echoes so that fish can be detected even when close to the bottom in the Raytheon DE-721A depth sounder sold by Coastal Radio (N.Z.) Ltd. The high definition recorder can be used as a "white line" unit or conventional echo depth sounder for either commercial fishing or navigation. Six scales are offered on seven ins. wide chart paper.

DAYLIGHT VIEWING RADAR

A shipborne radar with direct daylight viewing features has been developed for the first time since the introduction of marine radar. The Raytheon model 2502 transistorised radar, sold in this country by Coastal Radio (N.Z.) Ltd. permits the captain and watch officers to both plot on and interpret the display at the same time in normal daylight conditions.

Specifications

Power Requirements: 500 watts total from ship's main supply.
Power Supply: A transistorised power converter for 115 volts, 1000 cps, single phase output is provided. Available for operation from standard DC or AC ship's supply voltages.
Frequency: X Band (3 cm) — 9345 to 9405 megacycles.
Peak Transmitter Power: 20 kW nominal.
Pulse Lengths: 0.05 - 0.5 and 1 microseconds.
Repetition Rate: 6000-2000-1000 pulses per sec.
Transmitter Average Power: 6 and 20 watts.
Minimum Range: 10 metres.
Receiver Noise Figure: 11.5 db.
5.5° Antenna Horizontal Beamwidth: 1.5° at half power points.
Antenna Vertical Beamwidth: 25° at half power points.
Antenna Wind Loading: Normal operation in winds up to 80 knots.
Will not be damaged in winds up to 150 knots.
Indicator Picture Size: 10 inch diameter PP1 Tube.
Range Scales: ½-1½-3-6-12-24-48 nautical

ENQUIRY 232

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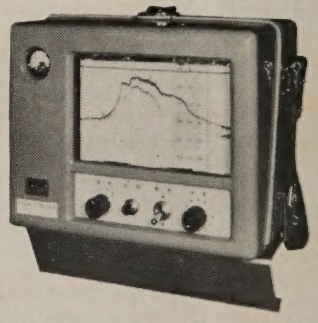
TRANSISTORISED FISH FINDER

An all transistorised small-size ultrasonic fish finder (Model NJA - 150) is being marketed in New Zealand by Elekon (Overseas) Ltd. Materials for side board or hull bottom installation are provided. The highly efficient instrument is manufactured in Japan.



Specifications

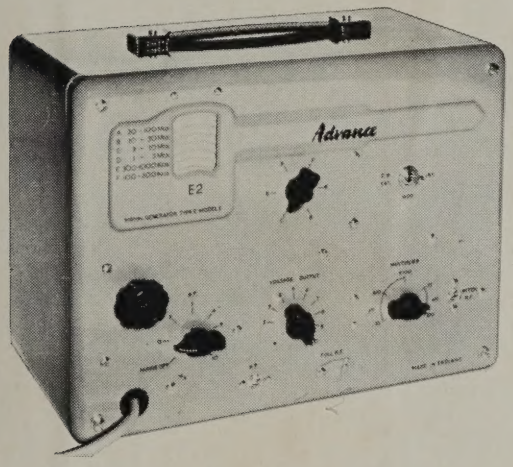
Depth Range: D type 400m (max).
E type 200m (max).
Frequency: 50 Kc transducer 1 pc.
Recording Paper: Dry recording system 100mm x 8m.
Power Supply: 8V, 12V, 24V, 24W.
Use: Purse-seine, trawler, dragnet and gillnet fishing.
Dimensions and weight: 268 x 200 x182 mm., 7 kgs.

ENQUIRY 238

Printed for the publishers, The Magazine Press Ltd., Employers Association Bldgs.; 157 Khyber Pass; Auckland, C.3. Farrell Printing Ltd., 69 Carr Rd., Mt. Roskill, Auckland.

ENQUIRY CARD AD. 27

Advance r.f. signal generators

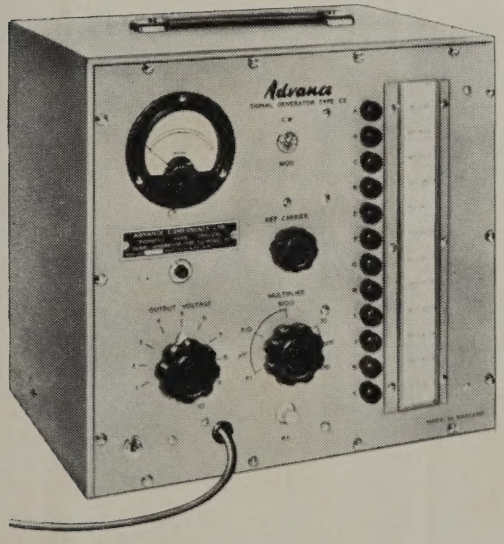


E2

R.F. Signal Generator

Frequency range 100kc/s to 100Mc/s in six bands. *Calibration accuracy* ±1%. *Output* Approximately 1V at the full R.F. socket. Continuously variable 1μV to 100mV. Accuracy of maximum output ±3dB. Accuracy of step attenuator ±(3dB + 3μV). *Output impedance* 75Ω unterminated. Normally this is matched with a 75Ω terminating pad TP1B, providing 37Ω, 10Ω and a standard 10Ω dummy aerial. *Modulation* INTERNAL 30% ±5% at 400c/s ±10%. EXTERNAL 0 to 80%, 10c/s to 4kc/s; 0 to 40% at 10kc/s. *A.F. output* 0 to 50V, 400c/s into high impedance. *Leakage* Less than 3μV. *Power requirements* 105 to 125V and 210 to 250V, 40 to 100c/s, 20W.

Dimensions 13in (33cm) wide × 10¼in (26cm) high × 8in (20·3cm) deep.
Weight 17½lb (8kg).



C2H

R.F. Signal Generator

Frequency range Twelve spot frequencies in the range 30kc/s to 40Mc/s. *Output* Continuously variable 1μV to 100mV. *Accuracy* Below 10Mc/s, ±1dB ±1μV; 10 to 40Mc/s, ±2dB ±2μV. *R.F. level* The R.F. level between push-button settings does not vary by more than ±3%. With ±10% a.c. supply variation, the output level change will not exceed ±3%. *Output impedance* 75Ω unterminated. *Modulation* Carrier internally amplitude modulated 30% ±5% at 400c/s ±5%. *Power requirements* 100, 210, 230, 250V, 40 to 100c/s, 25W. *Dimensions* 12¼in (31cm) wide × 13¼in (33·7cm) high × 10in (25·4cm) deep. *Weight* 28lb (12·7kg).

ADVANCE ELECTRONICS LIMITED ENGLAND

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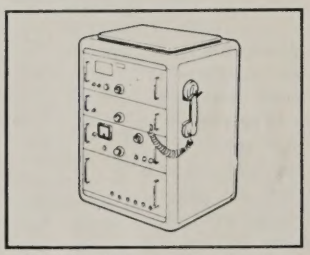
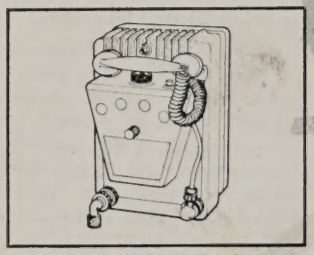
FROM THE COMPREHENSIVE RANGE OF Advance INSTRUMENTS AND EQUIPMENT

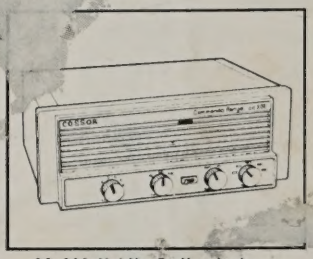
AUCKLAND HARBOUR N.Z.—VHF COMMUNICATION SY[illegible] COSSOR.



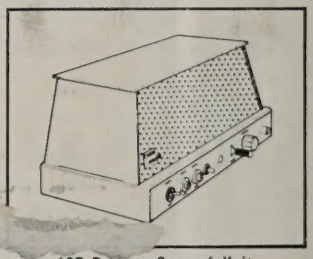
121 VHF FM Transmitter Receiver



CC 300m VHF FM Radiotelephone



CC 302 Mobile Radiotelephone



107 Remote Control Unit

COSSOR COMMUNICATIONS FOR THE PORTS OF THE WORLD

Cossor Communications Company Limited have for many years supplied VHF Radiotelephone equipment to professional users where reliability and consistent peak performance are mandatory.

Today the Cossor range of VHF Radiotelephone equipment meets every operational requirement from the most advanced pocket sets, through land and seaborne mobiles, to large base stations.

This range is supported by a long established and highly competent System Planning and Engineering team, the services of which are available without obligation to prepare proposals or design systems to meet any operational requirement.

Consult Cossor for Communications.

New Zealand Representatives:

Coastal Radio (NZ) Ltd,

C.P.O. Box 269 Napier

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